NEW NUCLEAR POWER PLANT IN TEMELÍN, INCLUDING POWER OUTPUT TO KOČÍN SWITCHYARD

ENVIRONMENTAL IMPACT ASSESSMENT DOCUMENTATION

Elaborated pursuant to Section 8 of and Annexe 4 to Act no. 100/2001 on Environmental Impact Assessment, as amended.

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[L.48] Decree no. 470/2001 Coll., laying down a list of important watercourses and procedures for the management of watercourses, as amended by Decree no. 333/2003 Coll. and Decree no. 267/2005 Coll., 470/2001 Coll.

[L.49] Decree no. 471/2001 Coll. on technical and safety supervision of water management structures, 471/2001 Coll.

[L.50] Decree no. 159/2003 Coll., establishing surface waters used for human bathing, as amended by Decree no. 168/2006 Coll. and Decree no. 152/2008 Coll., 159/2003 Coll.

[L.51] Decree no. 252/2004 Coll., laying down the health requirements for drinking and hot water and the frequency and extent of drinking water inspection, as amended by Decree no. 187/2005 Coll. and Decree no. 293/2006 Coll., 252/2004 Coll.

[L.52] Decree no. 450/2005 Coll. on the aspects of hazardous substances handling and on the aspects of the emergency plan, method and scope of accident reporting, rectification and elimination of harmful consequences of accidents., 450/2005 Coll.

Agricultural land fund protection

[L.53] Act no. 334/1992 Coll. on the protection of the Agricultural Land Fund, as follows from amendments made by Act no. 10/1993 Coll., Act no. 98/1999 Coll. (full wording of Act no. 231/1999 Coll.), Act no. 132/2000 Coll., Act no. 76/2002 Coll., Act no. 320/2002 Coll., Act no. 444/2005 Coll., Act no. 186/2006 Coll., Act no. 222/2006 Coll., Act no. 167/2008 Coll., and Act no. 9/2009 Coll., 334/1992 Coll.

[L.54] Decree no. 13/1994 Coll., regulating certain details concerning the protection of the agricultural land fund, 13/1994 Coll.

[L.55] Decree no. 327/1998 Coll., establishing the characteristics of Valuated Soil-Ecological Units (VSEU) and procedures applying to their registration and updating, as amended by Decree no. 546/2002 Coll., 327/1998 Coll.

Forest management

[L.56] Act no. 289/1995 Coll., on forests and amending certain acts (Forests Act), as amended by Act no. 238/1999 Coll., Act no. 67/2000 Coll., Act no. 132/2000 Coll., Act no. 76/2002 Coll., Act no. 320/2002 Coll. and Act no. 149/2003 Coll., Act no. 1/2005 Coll., Act no. 444/2005 Coll., Act no. 186/2006 Coll., Act no. 222/2006 Coll., Act no. 124/2008 Coll., and Act no. 167/2008 Coll., 289/1995 Coll.

[L.57] Decree no. 77/1996 Coll. on requisites for application for exemption or restriction and on details concerning protection of land intended to perform forest functions, 77/1996 Coll.

Nature and landscape protection

[L.58] Act no. 114/1992 Coll. on protection of nature and landscape, as amended by Legal Provision of the CNC Board no. 347/1992 Coll., Act no. 289/1995 Coll., Constitutional Court Ruling no. 3/1997 Coll., Act no. 16/1997 Coll., Act no. 123/1998 Coll., Act no. 161/1999 Coll., Act no. 238/1999 Coll., Act no. 132/2000 Coll., Act no. 76/2002 Coll., Act no. 320/2002 Coll., Act no. 100/2004 Coll., Act no. 168/2004 Coll., Act no. 218/2004 Coll., Act no. 387/2005 Coll., Act no. 444/2005 Coll., Act no. 186/2006 Coll., Act no. 222/2006 Coll., Act no. 124/2008 Coll., Act no. 167/2008 Coll. and Act no. 312/2008 Coll., Act no. 223/2009 Coll., Act no. 291/2009 Coll., Act no. 349/2009, and Act no. 381/2009, 114/1992 Coll.

[L.59] Act no. 16/1997 Coll., on conditions for imports and exports of endangered wild species of plants and animals and other provisions for the protection of such species, and on amendments of Czech National Council Act no. 114/1992 Coll., on protection of nature and landscape, as amended by Act no. 320/2002 Coll. and Act no. 100/2004 Coll., 16/1997 Coll.

[L.60] Act no. 100/2004 Coll. on the protection of species of wild fauna and flora by regulating trade therein and on further measures for protection of these species and on amendment of several acts (Act on trade in endangered species), as amended by Act no. 444/2005 Coll., 100/2004 Coll.

[L.61] Decree no. 395/1992 Coll., implementing certain provisions of Act no. 114/1992 Coll., on nature and landscape protection, as amended by MoE Decree no. 105/1997 Coll., MoE Decree no. 200/1999 Coll., Decree no. 85/2000 Coll., MoE Decree no.190/2000 Coll., Decree no. 116/2004 Coll., Decree no. 381/2004 Coll., Decree no. 573/2004 Coll., Decree no. 574/2004 Coll., Decree no. 452/2005 Coll., Decree no. 175/2006 Coll., Decree no. 425/2006 Coll., Decree no. 96/2007 Coll., Decree no. 141/2007 Coll., Decree no. 267/2007 Coll., Decree no. 60/2008 Coll., Decree no. 75/2008 Coll., Decree no. 30/2009 Coll., and Decree no. 262/2009 Coll., 395/1992 Coll.

[L.62] Decree no. 468/2004 Coll. on authorised persons pursuant to the Nature and Landscape Protection Act, 468/2004 Coll.

[L.63] Decree no. 166/2005 Coll., implementing certain provisions of Act no. 114/1992 Coll., on the conservation of nature and the landscape, as amended, in relation to the establishment of the NATURA 2000 network, as amended by Decree no. 390/2006 Coll., 166/2005 Coll.

[L.64] Decree no. 60/2008 Coll. on management plans, denomination and registration of sites protected under Act no. 114/1992 Coll. on protection of nature and landscape, as amended, and amending Decree no. 395/1992 Coll., implementing certain provisions of Act no. 114/1992 Coll., on protection of nature and landscape, as amended, (Decree on management plans, denomination and registration of protected sites), 60/2008 Coll.

[L.65] Decree no. 411/2008 Coll. on defining animal species requiring special care, 411/2008 Coll.

[L.66] Decree no. 4/2009 Coll. on protection of animals during transport, 4/2009 Coll.

Waste

[L.67] Act no. 185/2001 Coll. on waste and amendment to some related acts, as amended by Act no. 477/2001 Coll., Act no. 76/2002 Coll., Act no. 275/2002 Coll., Act no. 320/2002 Coll., Act no. 356/2003 Coll., Act no. 167/2004 Coll., Act no. 188/2004 Coll., Act no. 317/2004 Coll., Act no. 7/2005 Coll., Act no. 444/2005 Coll., Act no. 186/2006 Coll., Act no. 222/2006 Coll., Act no. 314/2006 Coll., Act no. 296/2007 Coll., Act no. 25/2008 Coll., Act no. 34/2008 Coll., Act no. 383/2008 Coll., Act no. 9/2009 Coll., Act no. 157/2009 Coll., Act no. 297/2009 Coll., and Act no. 326/2009 Coll., 185/2001 Coll.

[L.68] Act no. 477/2001 Coll. on packaging and amending certain acts (Packaging Act), as amended by Act no. 274/2003 Coll., Act no. 94/2004 Coll., Act no. 237/2004 Coll., Act no. 257/2004 Coll., Act no. 444/2005 Coll., Act no. 66/2006 Coll., Act no. 296/2007 Coll., Act no. 25/2008 Coll., and Act no. 126/2008 Coll., 477/2001 Coll.

[L.69] Decree no. 376/2001 Coll. on assessment of hazardous properties of wastes, as amended by Decree no. 502/2004 Coll., 376/2001 Coll.

[L.70] Decree no. 381/2001 Coll., which specifies the Catalogue of Wastes, the List of Hazardous Wastes and lists of wastes and countries for the purposes of export, import and transit of wastes and the procedure of granting permission for export, import and transit of wastes (Catalogue of Wastes), as amended by Decree no. 503/2004 Coll., Decree no. 168/2007 Coll., and Decree no. 374/2008 Coll., 381/2001 Coll.

[L.71] Decree no. 352/2005 Coll. on particulars of handling waste electrical and electronic equipment and on the detailed conditions of financing its handling (Decree on handling waste electrical and electronic equipment), 352/2005 Coll.

Prevention of major industrial incidents

[L.72] Act no. 59/2006 Coll., on the prevention of serious accidents caused by selected hazardous chemical substances or chemical preparations and on amendments to Act no. 258/2006 Coll., on the protection of public health and on amendments to related legislation, as amended, and Act no. 320/2002 Coll., on amendments to and the repeal of certain acts in relation to the termination of the activities of the district authorities (Act on the Prevention of Serious Accidents)

[L.73] Decree no. 103/2006 Coll., laying down fundamentals for designating emergency planning zones and the scope and method of preparing external emergency plans

[L.74] Decree no. 250/2006 Coll., laying down details concerning the scope of safety measures of physical protection of establishments or installations classified in group A or B

[L.75] Government Regulation no. 254/2006 Coll. on control of hazardous substances

[L.76] Decree no. 255/2006 Coll on the scope and method of the processing of a major accident report and final report of the incidence and consequences of a major accident

[L.77] Decree No 256/2006 Coll. on details of the system for the prevention of major accidents

Other documents

[O.1] Environmental Impact Assessment Report - Loviisa 3

[O.2] MAAE Safety Fundamentals

[O.3] MAAE Safety Requirements

[O.4] WENRA Reactor Safety Reference Level

[O.5] ČEZ presentation materials

[O.5] MIT, National Energy Policy of the Czech Republic, approved by Government Resolution no. 211 of 10 March 2004

[O.6] MIT, Updated National Energy Policy of the Czech Republic, Prague, October 2009

[O.7] Report of Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term; opponency version, 30 September 2008

List of abbreviations and acronyms

AAFP	Activation and Fission Products
AC	Alternating Current
AFCR	Armed Forces of the Czech Republic
AGR	Advanced Gas Cooled Reactor
ALARA	As Low As Reasonably Achievable
AMEC	part of the trade name of AMEC s.r.o. (not an abbreviation)
ANSI	American National Standards Institute
AM	Arithmetic Mean
APCS	Automated Process Control System
ASCR	Academy of Sciences of the Czech Republic
AAOB	Active Auxiliary Operations Building
BAT	Best Available Technique
BDBA	Beyond Design Basis Accident
BOC	Beginning of Cycle
BOL	Beginning of Life
VSEU	Valuated Soil Ecological Unit
SFP	Spent Fuel Pool
BWR	Boiling Water Reactor
ČEPS	part of the trade name of ČEPS, a.s. (not an abbreviation)
ČEZ	part of the trade name of ČEZ, a.s. (not an abbreviation)
CHMI	Czech Hydrometeorological Institute
WWTP	Waste Water Treatment Plant
CR	the Czech Republic
FS	Fuel Station
ČSN	Czech Technical Standard (or former Czechoslovak Technical Standard)
CZSO	Czech Statistical Office
COSMC	Czech Office for Surveying, Mapping, and Cadastre
CTU	Czech Technical University
DBA	Design Basis Accident
DBC	Design Basis Conditions
DC	Direct Current
DEC	Design Extension Conditions
DGS	Diesel Generator Station
DIAMO	part of the trade name of DIAMO, s.p. (not an abbreviation)
ALU	Affected Landscape Unit
ALT	Affected Landscape Territory
DCP	Documentation for Construction Permit
DSD	Detailed Seismic Districting
DSD	Documentation for Site Decision
ECCS	Emergency Core Cooling System
DNPP	Dukovany Nuclear Power Plant
EM	Energy Management
EIA	Environmental Impact Assessment
EMEP	European Monitoring and Evaluation Programme

EI	Equivalent Inhabitants
EOC	End of Cycle
EOL	End of Life
ER	Exposure Ratio
ERO	Energy Regulatory Office
PDS	Power Distribution System
EC	European Community
TPP	Temelín Power Plant
EU	European Union
EUR	European Utility Requirements
SAC	Special Area of Conservation
FD	Film Dosimeter
FNSPE	Faculty of Nuclear Sciences and Physical Engineering
PP	Physical Protection
GDC	General Design Criteria
GEAM	part of the trade name of a subsidiary plant of DIAMO, s.p. (not an abbreviation)
GM	Geometric Mean
GD FRS CR	General Directorate of the Fire Rescue Service of the Czech Republic
GCD	General Customs Directorate
IHB	Institute of Hydrobiology, Biology Centre of the AS CR
GDP	Gross Domestic Product
HDR	Hot Dry Rock
GWL	Groundwater Level
HSD	High Sleep Disturbance
MGU	Main Generating Unit
FRS	Fire Rescue Service
PLA	Protected Landscape Area
SCR	Spray Coolant Reservoir
PNWAA	Protected Natural Water Accumulation Area
CWTP	Chemical Water Treatment Plant
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IEC	International Electrotechnical Commission
INES	International Nuclear and Radiological Event Scale
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature and Natural Resources
IUR	Inhalation Unit Risk
IR	Ionising Radiation
IRS	Integrated Rescue System
S	South
NPP	Nuclear Power Plant
TNPP	Temelín Nuclear Power Plant
SSE	South Southeast
SSW	South Southwest
SE	Southeast
SW	Southwest
LU	Landscape Unit

CA	Controlled Area
LT	Landscape Territory
FEC	Final Energy Consumption
CMS	Crisis Management Staff
LAT	Low Assessment Threshold
LB	Left Bank
LBC	Local Biocentre
LBK	Local Biocorridor
LCA	Life-Cycle Assessment / Life-Cycle Analysis
LOAEL	Lowest Observable Adverse Effect Level
LOCA	Loss of Coolant Accident
LOFA	Loss of Flow Accident
LRKO	Surrounding Radiation Control Laboratory
LSD	Light Sleep Disturbance
M	Scale
MAAE	International Atomic Energy Agency (Czech and Slovak abbreviation)
MDA	Minimum Detectable Activity
MoF	Ministry of Finance
FMP CU	Faculty of Mathematics and Physics, Charles University
APMP	Air Pollution Measurement Point
FCMP	Food Contamination Measurement Point
WCMP	Water Contamination Measurement Point
MoD	Ministry of Defence
MIT	Ministry of Industry and Trade
MG	Mobile Group
MoI	Ministry of the Interior
MSA	Minimum Significant Activity
SHPP	Small Hydro Power Plant
MoH	Ministry of Health
MoA	Ministry of Agriculture
SSSPA	Small Scale Specially Protected Area
MRF	Minimum Residual Flow
MoE	Ministry of the Environment
H	Hazardous (waste category)
NATO	North Atlantic Treaty Organisation
NEA	Nuclear Energy Agency
IEC	Independent Energy Commission
NNPP	New Nuclear Power Plant
SLU	Superordinate Landscape Unit
SS	Suspended Solids
HW	Hazardous Waste
NOAEL	No Observable Adverse Effect Level
SR	Supraregional
SRBC	Supraregional biocentre
NRBK	Supraregional bio-corridor
NUREG	Nuclear Utility Regulation
RDD	Radiation Dosimetry Department

OECD	Organisation for Economic Cooperation and Development
OSART	Operational Safety Review Team
OSF	Oral Slope Factor
RES	Renewable Energy Sources
AWAQ	Area with Worsened Air Quality
PA	Postulated Accidents
RB	Right Bank
PCR	Police of the Czech Republic
(P)DEI	(Photon) Dose Equivalent Input
SPA	Special Protection Area
NM	Nature Monument
PoSR	Pre-operation Safety Report
NR	Nature Reserve
PSA	Probabilistic Safety Assessment
ABPS	Air By-Pass Station
LIFFF	Land Intended to Fulfil Forest Functions
TDP	Territorial Development Policy
PWR	Pressurised Water Reactor
RA	Risk Assessment
RAW	Radioactive Waste
RBC	Regional Biocentre
RBK	Regional Bio-corridor
RC SONS	Regional Centre of the State Office for Nuclear Safety
RfC	Reference Concentration
RfD	Reference Dose
RG	Regulatory Guide
RMN	Radiation Monitoring Network
RsC	Risk-specific Concentration
RsD	Risk-specific Dose
N	North
SD	Sleep Disturbance
SEA	Strategic Environmental Assessment
NEP	National Energy Policy
CMS	Control and Management System
SL	Safety Limit
NNE	North Northeast
NNW	North Northwest
STEM	Centre for Empirical Research
SONS	State Office for Nuclear Safety
NINCBP	National Institute for Nuclear, Chemical and Biological Protection, public research institution
RAWRA	Radioactive Waste Repository Authority
NRPI	National Radiation Protection Institute
NE	Northeast
SWB	Summary Water Balance
SNFR	Spent Nuclear Fuel Repository
NVI	National Veterinary Institute
EWN	Early Warning Network

NW	Northwest
CAFI	Czech Agriculture and Food Inspection Authority
TDS	Teledosimetric System
TG	Turbo Generator
TSCS	Taxonometric Soil Classification System
TLD	Thermoluminescence Dosimetry
LSO	Line Shut Off
DHW	Domestic Hot Water
PTW	Priority Technical Water
NPTW	Non-Priority Technical Water
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USNRC	United States Nuclear Regulatory Commission
US EPA	United States Environmental Protection Agency
IAP	Institute of Atmospheric Physics
CWTP	Cooling Water Treatment Plant
NPI	Nuclear Physics Institute
NRI	Nuclear Research Institute
DR	Dam Reservoir
RAWR	Radioactive Waste Repository
TSES	Territorial System of Ecological Stability
IHIS	Institute of Health Information and Statistics
CISTA	Central Institute for Supervising and Testing in Agriculture
E	East
WEW	Water Engineering Work
SNF	Spent Nuclear Fuel
ESE	East Southeast
VS	Ventilation Stack
PLF	Prominent Landscape Feature
HV	High Voltage
NG	Noble Gases
ENE	East Northeast
HPR	High-Pressure Regeneration
LTU	Large Territorial Unit
FGMRI	Forestry and Game Management Research Institute
TGM WRI	T.G.M. Water Research Institute
ICT	Institute of Chemical Technology
VHV	Very High Voltage
HVAC	Heating, Ventilating, and Air Conditioning
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators' Association
WHO	World Health Organisation
YPLL	Years of Potential Life Lost
W	West
ASR	Assignment Safety Report
EPZ	Emergency Planning Zone
SPA	Specially Protected Area

WSW	West Southwest
BLU	Basic Landscape Unit
ALF	Agricultural Land Fund
WNW	West Northwest
Env.	Environment(al)

Overview of basic terminology

This chapter presents an overview of some terms (related to this documentation) established by legislation of the Czech Republic and related terms.

Basic terms of Act no. 18/1997 Coll. on peaceful utilisation of nuclear energy and ionising radiation (Atomic Act), as amended

Activity associated with utilisation of nuclear energy:

1. location, construction, commissioning, operation, renovation and decommissioning of nuclear facilities,
2. nuclear facility design,
3. designing, manufacturing, repairs and testing of nuclear facility systems or parts thereof, including materials for their manufacturing,
4. designing, manufacturing, repairs and testing of packaging assemblies for transportation, storage or deposition of nuclear materials,
5. handling of nuclear materials and selected items, including dual-use items if used in the nuclear sector,
6. research and development in the activities listed in 1 to 5 above,
7. professional training of natural persons specialising on nuclear safety issues for activities listed in 1 above,
8. transportation of nuclear materials.

Activity resulting in irradiation:

1. radiation activity, which is:

a) activity using artificial sources of ionising radiation which may cause increased irradiation of natural persons, except activity in the event of a radiation emergency, or

b) activity in which natural radionuclides are used for their radioactive, fission or breeding characteristics,

2. activity related to work that is associated with an increased presence of natural radionuclides or increased effect of cosmic radiation and results, or can result, in a significant increase in irradiation of natural persons.

Diagnostic reference level: A guideline value for irradiation in medical radiodiagnostics

Physical protection: A system of technical and organisational measures preventing unauthorised operations using nuclear facilities, nuclear materials and selected items

Emergency plan: A set of planned measures to eliminate a radiation incident or radiation accident and to reduce its consequences, which is elaborated for

1. the spaces of a nuclear facility or workplace where radiation operations take place (internal emergency plan),
2. transportation of nuclear materials or sources of ionising radiation (emergency rules),
3. an area surrounding a nuclear facility or workplace containing a source of ionising radiation, in which results of analyses of potential consequences of a radiation accident indicate the application of emergency planning requirements, referred to as the emergency planning zone (external emergency plan),

Emergency preparedness: Ability to recognise the occurrence of a radiation emergency and perform requirements set by emergency plans when it occurs.

Ionising radiation: Energy transfer in the form of particles or electromagnetic waves at wavelengths shorter than or equal to 100 nanometres, and/or frequencies higher than or equal to 3×10^{15} Hz, which is capable of creating ions directly or indirectly.

Nuclear safety: The condition and capacity of a nuclear facility and persons operating the nuclear facility to prevent uncontrolled development of a fission chain reaction or unauthorised leakage of radioactive substances or ionising radiation into the environment, and reduce the consequences of accidents.

Nuclear item: 1. nuclear materials, which are

a) original materials, meaning uranium, including a mixture of naturally occurring isotopes, uranium depleted of ^{235}U or thorium, and each of the said items in the form of metal, alloy, chemical compound or concentrate, as well as materials containing one or more of the said items at a concentration or quantity exceeding limits set by an executive legal regulation,

b) special fission materials, meaning ^{239}Pu, ^{233}U enriched with ^{235}U or ^{233}U, and materials containing one or more of the said radionuclides, except original materials, at a concentration or quantity exceeding limits set by an executive legal regulation,

c) other materials if so specified by an executive legal regulation,

2. selected items, which are materials, facilities and technologies designed and manufactured for use in the nuclear sector, the list of which is made in an executive legal regulation,

3. dual-use items, which are materials, facilities and technologies that are not designed and manufactured for use in the nuclear sector but can be used in the sector, the list of which is made in an executive legal regulation.

Nuclear facility: 1. buildings and process units that include a nuclear reactor employing fission chain reaction,

2. facilities for manufacturing, processing, storage and depositing of nuclear materials, except uranium ore processing plants and uranium concentrate storage facilities,

3. radioactive waste repositories, except repositories containing exclusively natural radionuclides,

4. facilities for storing radioactive waste, the activity of which exceeds limits set by an executive legal regulation.

Individual within a population: Any natural person, except radiation workers doing their work, natural persons during practical occupational training, natural persons exposed to irradiation for the purpose of their medical examination or treatment, natural persons that unprofessionally accompany or voluntarily assist persons exposed to irradiation as part of a medical examination or treatment, and natural persons voluntarily participating in methods that have not yet been established in clinical practice.

Controlled area: Spaces with regulated access in which special rules exist for ensuring radiation protection or prevention of spreading radioactive contamination.

Critical population group: A model group of natural persons which represents those individuals in the population who are most irradiated from a given source and by a given pathway.

Limits and requirements of safe operation of a nuclear facility: A set of clearly defined requirements proving that the operation of a nuclear facility is safe and comprising data on admissible parameters, requirements on facility operability, establishment of protective systems, requirements on workers' work and organisational measures to meet all the defined requirements on design operating conditions.

Threshold level: An indicator or criterion for controlling inadmissible irradiation by natural radionuclides.

Radiation protection optimisation: Procedures to achieve and maintain such a level of radiation protection that make the risk of endangerment of life, health of persons and the environment as low as can be reasonably achieved while considering economic and social implications.

Optimisation limit: The upper limit of anticipated doses through which a source may affect natural persons and which is defined for the purpose of optimisation of radiation protection.

Irradiation: Exposure of natural persons and the environment to ionising radiation, in particular

1. professional irradiation of natural persons related to work on radiation activities,

2. medical irradiation of natural persons

aa) as part of their medical examination or treatment,

bb) as part of professional medical care and preventive medical care,

cc) as part of authentication of new findings and/or when employing methods not yet established in clinical practice,

dd) for purposes defined by a special legal regulation,

3. accidental irradiation of natural persons in consequence of a radiation incident or radiation accident, except accidental irradiation of intervening persons,

4. accidental irradiation of intervening natural persons voluntarily involved in an intervention during which any of the irradiation limits set for radiation workers might be exceeded,

5. persistent irradiation resulting from long-term effects of a radiation emergency or resulting from an activity resulting in irradiation which has ended,

6. potential irradiation, which cannot be anticipated with certainty but the likelihood of which can be estimated in advance.

Radiation accident: A radiation incident the effects of which require urgent measures to protect the population and the environment.

Radiation emergency: A situation following a radiation accident or a radiation incident or a detection of increased radioactivity or irradiation level that requires urgent measures to protect natural persons.

Radiation incident: An event resulting in an impermissible release of radioactive substances or ionising radiation or impermissible irradiation of natural persons.

Radiation protection: A system of technical and organisational measures to reduce the irradiation of natural persons and protect the environment.

Radiation worker: Any natural person exposed to professional irradiation, regardless whether they are an employee or a natural person performing an activity under a different legal relationship.

Radioactive substance: Any substance that contains one or more radionuclides and the activity or specific activity of which is not negligible in terms of radiation protection.

Radioactive waste: Substances, objects or facilities containing or contaminated with radionuclides, the continued use of which is not assumed.

Reference level: An indicator or criterion which the exceeding or failing of results in radiation protection measures; an executive legal regulation sets out details on specification of reference levels and measures in consequence of exceeding them.

Storage of radioactive waste and spent nuclear fuel: The placement of radioactive waste or spent/irradiated nuclear fuel in allocated spaces, buildings or facilities for a period of time that is limited in advance.

Controlled area: Spaces subject to continuous supervision for radiation protection purposes.

Indicative value: An indicator or criterion for assessing the level of radiation protection to be used in the event of unavailability of detailed information on the activity resulting in irradiation being performed or on the intervention being performed that would make it possible to assess the optimisation of radiation protection for the specific case.

Technical safety: The capacity of selected equipment to not endanger human health and property during activities connected to utilisation of nuclear energy under specified conditions throughout its lifetime, and ensure consistent compliance with technical requirements contained in an executive legal regulation or another binding technical specification for the selected equipment.

Deposition of nuclear waste: Permanent placement of radioactive waste in spaces, buildings or facilities without the intention of relocating them.

Nuclear waste repository: A space, building or facility on the surface or underground used for deposition of radioactive waste.

Release level: The value of specific activity or total activity which, when not exceeded, permits radioactive waste, radioactive substances, and objects or facilities containing or contaminated with radionuclides to be introduced into the environment without permission of the State Office for Nuclear Safety.

Selected equipment: Components or systems of nuclear facilities important in terms of nuclear and technical safety, classified into safety classes depending on their importance to the safety of the nuclear facility operation, the safety purpose of the system in which they are included, and the significance of their potential failure. The criteria for classification and division of selected equipment into safety classes are defined by an executive legal regulation.

Decommissioning: Activities the purpose of which is to release nuclear facilities or workplaces where radiation activities were performed for other uses.

Intervention: Activities aimed at averting or reducing irradiation by sources of ionising radiation that are not the subject matter of radiation activities resulting in irradiation, or the control over which has failed, by means of action towards sources, pathways or irradiated persons.

Health detriment: The probability of detriment to health caused by the somatic effects of ionising radiation, including cancer, and serious genetic disorders that may occur in natural persons after being irradiated with ionising radiation, that is determined by estimating the risk of reduced life-span and quality of life.

Source of ionising radiation: A substance, device or facility that may emit ionising radiation or release radioactive substances.

Exemption level: The value of specific activity or total activity which, when not exceeded, makes contamination with radionuclides to be regarded as negligible as a rule.

Basic terminology of SONS Decree no. 307/2002 Coll. on radiation protection, as amended

Activation: A process during which a stable nuclide is transformed into a radionuclide by being irradiated with high-energy particles or gamma rays.

Normal operation: Operation of a source of ionising radiation under conditions defined in its operating or handling permit and in approved documentation.

Cosmic radiation: Ionising radiation of cosmic origin.

Monitoring: Targeted measurement of quantities characterising irradiation, field of radiation or radionuclides, and interpretation of the results of such measurement in order to coordinate irradiation.

Personal doses: A summary term for quantities characterising the degree of external and internal irradiation of a single person, especially the effective dose, committed effective dose and equivalent doses in each organ or tissue; personal doses are measured by personal dosimeters.

Natural source of ionising radiation: A source of ionising radiation of terrestrial or cosmic origin.

Radionuclide: A type of atom that has the same number of protons, the same number of neutrons, the same energy state, and is subject to spontaneous change in the composition or state of the atomic nucleus.

Artificial source of ionising radiation: A source of ionising radiation other than a natural source of ionising radiation.

Internal irradiation: Irradiation of a person with radiation from radionuclides present in the person's body, usually as a consequence of accepting the radionuclides by ingestion or inhalation.

Discharge: Liquid or gaseous substance discharged into the environment that contains radionuclides at a quantity not exceeding the release levels or discharged into the environment under conditions specified in a permit to introduce radionuclides into the environment.

External irradiation: Irradiation of a person with ionising radiation from sources of ionising radiation located outside the person.

Disposal of radioactive waste: Placement of radioactive waste in a repository or a specific location without the intent to reuse it; disposal also includes authorised release of radioactive waste directly into the environment and its subsequent dispersion.

Basic terminology in SONS Decree no. 195/1999 Coll. on the requirements for nuclear installations relating to nuclear safety, radiation protection and emergency preparedness, as amended

Abnormal operation: Conditions, operations and events deviating from normal operation that are not planned but the occurrence of which can be expected during operation of a nuclear facility; they include, among others, quick shutdown, sudden drop in load, turbine failure, loss of grid power supply, reactor circulation pump failure, etc.; these operating conditions must not lead to damage of the fuel system or breach of fuel elements and to a disruption of integrity of the primary circuit; the nuclear facility is capable of normal operation once they are ended or their causes and effects are eliminated.

Accidental conditions: All events caused by a failure or disruption of structural frameworks, process assemblies and equipment, external factors or operator error that result in violation of limits and safe operation conditions and that may result in damage to the fuel system or a breach of fuel elements.

Simple failure: An event leading to the loss of ability of an element to perform its defined function, while all other elements work correctly; subsequent failures induced by the initial simple failure are considered part of the simple failure.

Maximum design basis accident: Design basis accident assumed in a nuclear facility design with the greatest radiation consequences.

Fuel element limit parameters: Maximum parameters of fuel elements and degree of their damage that must not be exceeded in normal and abnormal operation.

Lowest realistically achievable doses of ionising radiation: Values optimised in terms of radiation protection under a special legal regulation.

Normal operation: All states and operations of the planned operation of a nuclear facility while respecting limits and requirements for the safe operation of the nuclear facility; these include, in particular, repeated induction of critical condition of the reactor, increasing and decreasing of its output, maintenance, repairs, and fuel replacement.

Fuel element: A structural unit the basic component of which is nuclear fuel; it includes casing, fuel tablets, filling gas, springs, lids, etc.

Fuel assembly: An assembly of fuel elements that is normally not disassembled when replacing fuel in a reactor; in addition to fuel elements, it includes spacing grates, top and bottom flanges, and, as may be applicable, guiding tubes for interior instrumentation or for control bar bundles or for neutron sources or for assemblies with discrete burning absorbers, and the fuel assembly envelope.

Fuel system: Fuel assemblies and their components, interior control components of the active zone such as control bars, bars with burning absorbers, if any are used, bars with neutron sources, rest plates, etc.

Breach of fuel elements: Breach of the hermeticity of the casing, thus the possibility of release of fission products into the surroundings.

Damage to the fuel system: Breach of fuel elements or exceeding the dimension tolerance for operation states or change of the functional capacity beyond the limit assumed in safety analyses.

Design basis accident: An accident assumed in the design for a nuclear facility that may result in a release of radionuclides, ionising radiation or irradiation of persons.

Design limits for normal and abnormal operation: Values of parameters which, until achieved, guarantee the capacity to perform design functions and prevent the unauthorised release of radionuclides into the environment.

Overview of basic quantities and units

This chapter contains a selection of important quantities and units in the sphere of radiation protection and ionising radiation in general as established by legislation and standards of the Czech Republic. Moreover, it contains a selection of the basic quantities and units used within this documentation. The overview is made to facilitate understanding of the documentation, and does not aspire to be exhaustive.

Basic quantities and units used in the sphere of radiation protection and ionising radiation

Activity A: The quotient of the mean quantity of spontaneous radioactive transformations from a given energy state in a specified quantity of radionuclides in a short period of time and of that period. The unit of activity is a reciprocal second (1/s), which is termed a Becquerel [Bq].

Nominal activity: Activity related to the unit mass of an emitter [Bq/kg].

Areal activity: Activity related to the unit area of an emitter [Bq/m^2].

Volumetric activity: Activity related to the unit volume of an emitter [Bq/m^3].

Dose D: Also absorbed dose. The quotient of mean energy transmitted via ionising radiation to a defined mass of substance. The unit of dose is J/kg, which is termed a gray [Gy].

Dose rate: Dose increment over a period of time. The unit of dose rate is 1 gray per second [Gy/s].

Equivalent dose H_T: The product of the radiation weight factor w_R specified in Table 1 in Annexe 5 to SONS Decree no. 307/2002 Coll. and the mean absorbed dose (ČSN ISO 31-9 Quantities and units. Part 9: Atomic and nuclear physics; ČSN ISO 31-10 Quantities and units. Part 10: Nuclear reactions and ionising radiation) D_{TR} in an organ or tissue T for ionising radiation R, or a sum of such products if the field of ionising radiation is composed of multiple types or energies. The unit of equivalent dose is 1 sievert [Sv].

Effective dose E: The sum of products of tissue weight factors w_T specified in Table 2 in Annexe 5 to SONS Decree no. 307/2002 Coll. and the equivalent dose H_T in irradiated tissues or organs T. The unit of effective dose is 1 sievert [Sv].

Collective effective/equivalent dose S: The sum of effective/equivalent doses to all individuals in a group. The unit of collective effective/equivalent dose is 1 sievert [Sv].

Committed effective dose $E(\tau)$ or equivalent dose $HT(\tau)$: A time integral of effective/equivalent dose rate over time τ from acceptance of a radionuclide. The unit of committed effective/equivalent dose is 1 sievert [Sv].

Dose equivalent H: The product of absorbed dose in the assumed tissue point and the quality coefficient Q specified in Table 3 in Annexe 5 to SONS Decree no. 307/2002 Coll., expressing the different biological effect of different types of radiation. The unit of dose equivalent is 1 sievert [Sv].

Personal dose equivalent $H_p(d)$: Dose equivalent in a given point under the surface of the body at tissue depth d. The unit of personal dose equivalent is 1 Sievert [Sv].

Other basic quantities and units

SI base units:

Length: The unit is 1 metre [m].

Mass: The unit is 1 kilogram [kg].

Time: The unit is 1 second [s].

Electric current: The unit is 1 ampere [A].

Thermodynamic temperature: The unit is 1 kelvin [K].

Amount of substance: The unit is 1 mole [mol].

Luminous intensity: The unit is 1 candela [cd].

SI derived units with special names, including prefixes:

Angle: The unit is 1 radian [rad]. 1 rad = 1 m/m = 1.

Solid angle: The unit is 1 steradian [sr]. 1 sr = 1 m^2/m^2 = 1.

Frequency: The unit is 1 hertz [Hz]. 1 Hz = 1/s.

Force: The unit is 1 newton [N]. 1 N = 1 $kg.m/s^2$.

Pressure, stress: The unit is 1 pascal [Pa]. 1 Pa = 1 N/m^2.

Energy, work, heat: The unit is 1 joule [J]. 1 J = 1 N.m.

Power, radiant flux: The unit is 1 watt [W]. 1 W = 1 J/s. Note: This documentation makes a further distinction between thermal power [Wt] and electric power [We].

Electric charge, quantity of electricity: The unit is 1 coulomb [C]. 1 C = 1 A.s.

Electrical potential, potential difference, voltage, electromotive force: The unit is 1 volt [V]. 1 V = 1 W/A.

Electric capacitance: The unit is 1 farad [F]. 1 F = 1 C/V.

Electric resistance: The unit is 1 ohm [Ω]. 1 Ω = 1 V/A.

Electrical conductance: The unit is 1 siemens [S]. 1 S = 1/ Ω.

Magnetic flux: The unit is 1 weber [Wb]. 1 Wb = 1 V.s.

Magnetic flux density: The unit is 1 tesla [T]. 1 T = 1 W/m^2.

Inductance: The unit is 1 henry [H]. 1 H = 1 Wb/A.

Celsius temperature: The unit is 1 celsius [°C]. 1°C = 1 K. Note: Celsius is a special name for a kelvin when quoting celsius temperature.

Luminous flux: The unit is 1 lumen [lm]. 1 lm = 1 cd.sr.

Illuminance: The unit is 1 lux [lx]. 1 lx = 1 lm/m^2.

Units used with SI:

Time: minute [min]. 1 min = 60 s
hour [hr]. 1 hr = 60 min
day [d]. 1 d = 24 hr

Angle: degree [°].1° = (π/180) rad.
minute [']. 1' = (1/60)°.
second ["]. 1" = (1/60)'.

Volume: litre [l, L]. 1 l = 1 dm^3. Note: Both symbols for litre can be used. This documentation uses the symbol l.

Weight: tonne [t]. 1 t = 10^3 kg.

SI prefixes:

factor	name	symbol
10^{24}	yotta	Y
10^{21}	zetta	Z

10^{18}	exa	E
10^{15}	peta	P
10^{12}	terra	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hekto	h
10	deca	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a
10^{-21}	zepto	z
10^{-24}	yokto	y

Note: This documentation also uses unit factors (and large number expressions in general) in the form using the letter E. The reading 1.23E12 thus corresponds to $1.23.10^{12}$; 4.56E-06 corresponds to $4.56.10^{-6}$, etcetera. These denotations are largely the output of computational software logs and are not always transformed into the more common exponential form. This is merely a formal method of denomination without effect on actual values.

Introduction

General information

The environmental impact assessment documentation (hereinafter, the documentation) for

NEW NUCLEAR POWER PLANT IN TEMELÍN,
INCLUDING POWER OUTPUT TO KOČÍN SWITCHYARD

is elaborated pursuant to Section 8 of Act no. 100/2001 Coll. on Environmental Impact Assessment, as amended by Acts nos. 93/2004 Coll., 163/2006 Coll., 186/2006 Coll., and 216/2007 Coll. (hereinafter, the Act).

The documentation was elaborated between December 2008 and May 2010.

The purpose of the documentation is to provide basic information on the project as well as identify, describe and evaluate and assess the assumed direct and indirect impacts of implementing and not implementing the project on the environment as required by the Act.

The documentation elaboration was preceded by an ascertainment procedure pursuant to Section 7 of the Act. The conclusions of the ascertainment procedure (along with the previously elaborated notification) are some of the fundamental sources of information for the elaboration, and the documentation follows up on them both procedurally and factually. However, these sources of information are adopted neither literally nor uncritically.

The documentation is the outcome of work of a team of experts specialised on the individual environmental components. A list of their names is made on the opening pages.

Definition of affected and study areas

Affected area

Pursuant to Act no. 100/2001 Coll. on environmental impact assessment, the term *"affected area"* refers to an area "the environment and population of which might be seriously affected by the project implementation". According to this definition, the affected area is limited to the project area and its nearest vicinity; the environment and/or population in the broader context (based on the results of the environmental impact assessment) will not be affected.

The affected area comprises areas intended for the project construction and the related building and process structures, including site facility areas. This area is already being affected by the existing 2x1000 MW_e power plant (or the previous construction thereof), since the original design was to build a 4x1000 MW_e power plant and its construction was commenced.

Study area

For the purpose of elaborating the documentation (performance of surveys and assessment), its elaboration has assumed the term *"study area"*, defined based on the component environmental spheres. The area falling under this working definition is of a more general nature than the "affected area" and is much larger. It can be said that we have analysed potential impacts within hundreds of kilometres (including a consideration of potential transboundary impacts); however, the description of the impacts themselves is only made within their realistic ranges of effect.

Content and extent of the documentation

Formal documentation framework

The content and extent of the documentation are formally laid out by the requirements of Act no. 100/2001 Coll. on environmental impact assessment, as amended. They are based on Annexe 4 to the Act (Documentation requisites), which is respected in full.

Factual documentation framework

The factual framework of the documentation is based firstly on the ascertainment procedure conclusion, issued by the Ministry of the Environment (ref. no. 8063/ENV/09 of 3 February 2009); secondly, it is generally defined by the specifications of the project, which is a nuclear facility.

The different environmental components will be affected by the project impacts to varying degrees. Legislation in force does not allow exclusion of any environmental component (less significant to the assessment): the assessment needs to be done in the full scope. The documentation respects that. At the same time, some environmental components receive more attention, proportionate to their significance. Concerning nuclear facilities, special attention is paid to issues of radiation impacts and impacts on population and public health. At the same time, increased attention is paid to issues of impacts on climate and impacts on aquatic and biotic environments.

A list of annexes that are part of this documentation is made in section H hereof (page 558 of this documentation).

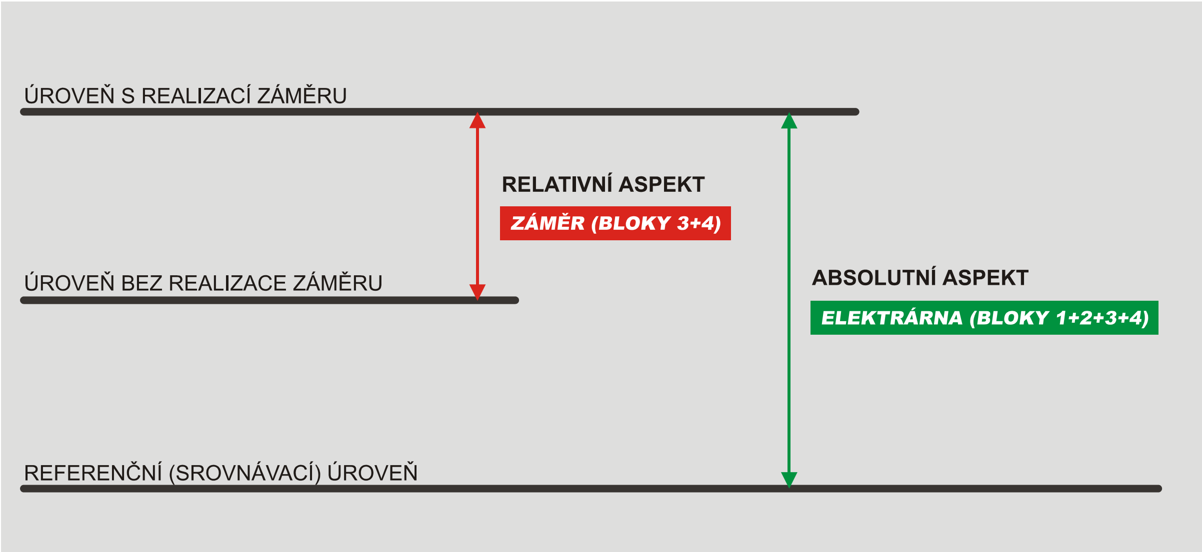
Aspects of environmental impact assessment

The documentation deals firstly with assessment of the impacts of the project as such (i.e., units 3+4 including related structures and process units), and secondly with assessment of the impacts of the entire Temelín Power Plant including the project (i.e., units 1+2+3+4 including related structures and process units). This approach results in both respecting the formal assignment of the documentation objective and preserving the factual meaning of the environmental impact assessment (which we deem more important). The reason is that in addition to the impacts of the project as such, we also assess the impact of the entire power plant following the extension: its resulting effect.

For the said reasons, the documentation aims at quoting information and assessing impacts in two fundamental aspects. The first aspect is relative (encompassing the new plant project only); the other aspect is absolute (encompassing the entire power plant after the new plant is built).

The following figure shows the general importance of the two aspects:

Figure 0.1: Assessment aspects



ÚROVEŇ S REALIZACÍ ZÁMĚRU	*LEVEL AFTER PROJECT COMPLETION*
ÚROVEŇ BEZ REALIZACE ZÁMĚRU	*LEVEL BEFORE PROJECT*
RELATIVNÍ ASPEKT	*RELATIVE ASPECT*
REFERENČNÍ (SROVNÁVACÍ) ÚROVEŇ	*REFERENCE (COMPARISON) LEVEL*
ZÁMĚR (BLOKY 3+4)	*PROJECT (UNITS 3+4)*
ABSOLUTNÍ ASPEKT	*ABSOLUTE ASPECT*
ELEKTRÁRNA (BLOKY 1+2+3+4)	*POWER PLANT (UNITS 1+2+3+4)*

This approach to the assessment and quoting of information is employed wherever information on the project as such, and on the power plant after the extension, has to be or should be differentiated. It is therefore employed in chapters B.II. Information on inputs (page 185 in this document), B.III Information on outputs (page 198 in this document), and D.I Description of expected project impacts on the population and the environment and assessment of their extent and significance (page 372 in this documentation).

The said approach also concerns issues of safety, which are dealt with in Chapter D.III.DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).

Method of assessing environmental impacts of the project

The method of assessing environmental impacts of the project is defined in Section 5 of the Act; its requirements are as follows:

(1) Assessment involves the identification, description and evaluation and assessment of the assumed direct and indirect impacts of implementing and not implementing the project on the environment.

(2) The environmental impact assessment shall be based on the state of the environment in the affected area at the time of notification of intent. For long-term projects, its stages shall be assessed separately and in the context of the impacts of the project as a whole.

(3) The project assessment shall assess environmental impacts during its preparation, execution, operation and termination, consequences of its disposal if any, and remediation or reclamation of land if a special legal regulation prescribes remediation or reclamation. Both normal operation and the potential for an accident shall be assessed.

(4) The assessment of the project shall include proposed measures to prevent adverse environmental impacts due to project execution, to eliminate, reduce, mitigate or minimise such impacts, or to increase beneficial environmental impacts due to project execution if any, including an assessment of the assumed effects of the proposed measures.

These requirements are respected in the documentation as follows:

(1) The documentation contains an impact assessment for both the execution alternative (i.e., project execution) and the zero alternative (i.e., project not executed).

(2) The initial state of the environment is related to the time of notification, which was published on 6 August 2008. The description of the state of the environment related to that time (not necessarily to the exact date) is extended with development trends both past and expected in some cases. The project is not divided into stages that should be assessed separately.

(3) The documentation includes an assessment for both the project operation (which is the primary objective of the assessment) and its preparation and execution as well as its termination. Speaking of which, the termination of the project operation is perceived by both Act no. 100/2001 Coll. on environmental impact assessment[1] and Act no. 18/1997 Coll. (Atomic Act)[2] as a separate project for which an environmental impact assessment is required. The termination of the project operation will therefore be the subject matter of a separate environmental impact assessment process as part of its preparation. This documentation thus considers the termination of the operation only in the broader context of the impacts of the project as a whole, which are assessed at the level of knowledge available at the time of elaboration and which are necessarily of a policy or strategic, rather than very specific, nature due in particular to the distant time horizons. In addition to normal operation, the documentation also assesses the potential for an accident. This sphere is dealt with at the environmental level (assessment of environmental impacts in the event of a potential accident), but it must not be mistaken for an assessment of the nuclear safety of the project from the technical or organisational point of view. Information concerning the degree of nuclear safety of the project (or its constituent process components) in the technical or organisational sense is not the subject matter of this documentation: environmental impact documentation is not nuclear facility safety documentation. For more on this issue, see the chapter on "Method of assessing issues of nuclear safety, radiation protection and emergency preparedness" below.

(4) The documentation shall contain a proposal of appropriate measures. Measures resulting from generally binding regulations are not described in detail in most cases; they are assumed to be respected and inspected by relevant authorities. The documentation therefore put primary emphasis on measures that go beyond the scope of generally binding regulations.

Method of assessing issues of nuclear safety, radiation protection and emergency preparedness

Requirements on nuclear facilities with respect to nuclear safety, radiation protection and emergency preparedness are laid out by Act no. 18/1997 on peaceful utilisation of nuclear energy and ionising radiation (Atomic Act) and related executive legal regulations. State administration and supervision in this area is within the powers of the State Office for Nuclear Safety (SONS), which issues permits for activities only based on applications supported with documentation containing the statutory information, including relevant safety analyses and certificates.

The scope of action of the SONS is defined in Section 3 of Act no. 18/1997 Coll. As part of its state administration and supervision over utilisation of nuclear energy, it issues permits for activities which are defined in Section 9, paragraph 1 of the Atomic Act. The permits are as follows:

a) permit to locate a nuclear facility or radioactive waste repository;
b) permit to build a nuclear facility or Class IV workplace;
c) permit for constituent stages of commissioning a nuclear facility;
b) permit to operate a nuclear facility or Class III or IV workplace;
e) permit to repeatedly induce the critical state of a nuclear reactor following nuclear fuel replacement;
f) permit to perform reconstruction or other changes affecting nuclear safety, radiation protection, physical protection or emergency preparedness of a nuclear facility or Class III or IV workplace;
g) permit for constituent stages of decommissioning a nuclear facility or Class III or IV workplace;
h) permit to introduce radionuclides into the environment;
i) permit to handle sources of ionising radiation;
j) permit to handle radioactive waste;

[1] Annexe 1 to Act no. 100/2001 Coll., item 3.2 Facilities with nuclear reactors (including their dismantling or final shutdown) except research facilities the maximum power output which does not exceed 1 kW of thermal load.

[2] Section 13, paragraph 4 of Act no. 18/1997 Coll.

k) permit to import or export nuclear items or transit nuclear materials and selected items;

l) permit to handle nuclear materials;

m) permit to transport nuclear materials and radioactive substances;

n) permit for professional training to selected workers;

o) permit for reimporting radioactive waste generated from materials exported from the Czech Republic in order to process (reprocess) them;

p) permit for international transport of nuclear waste;

r) permit to perform personal dosimetry and other services significant with respect to radiation protection;

s) permit to add radioactive substances to consumer products during their production or preparation or to import or export such products.

However, pursuant to Section 9, paragraph 2 of the Atomic Act, these permits do not supersede permits or authorisations issued by other administrative authorities pursuant to special regulations. It follows that acquisition of a SONS permit for any of the said activities is a required precondition but insufficient if interests managed by any other state administration authorities are affected.

A precondition for the issuance of a permit under Section 9, paragraph 1, items a), b) and g) of the Atomic Act is an environmental impact assessment if a special legal regulation (Act no. 100/2001 Coll. on environmental impact assessment) specifies so.

A precondition for the issuance of a permit under Section 9, paragraph 1, item f) of the Atomic Act is an environmental impact assessment pursuant to a special act of law (Act no. 100/2001 Coll. on environmental impact assessment) in case of a reconstruction or another change impacting on nuclear safety, radiation protection, physical protection and emergency preparedness of a nuclear facility or Class III or IV workplace is associated with an increase in the authorised discharge limits as defined by SONS pursuant to Section 4, paragraph 6 of the Atomic Act.

The elaboration of an environmental impact assessment is thus a precondition for the issuance of a permit to locate or build a project. The environmental impact assessment therefore has to be undertaken prior to the permit procedure for location or building of the project. Both the processes (the environmental impact assessment process and the ensuing SONS licensing procedure) are factually independent of one another.

This project environment impact documentation therefore deals with issues of nuclear safety, radiation protection, physical protection and emergency preparedness at the environmental level, that is, in respect of environmental impacts[1]. However, it does not deal with those issues from the technical or organisational perspectives, i.e., from design (engineering) and operating perspectives[2].

The information shown in this documentation concerning the provision of nuclear safety, radiation protection, physical protection and emergency preparedness of the project and its components from the technical and/or organisational perspectives is based on information provided by suppliers of the component technologies, requirements of legislation in force and requirements of any applicable industry regulations and agreements. This information is the basis for the elaboration of the documentation, not its subject matter: it is described but not assessed. We assume the ensuing issuance of all the necessary permits within the jurisdiction of SONS. It does not matter that it will only be the case later. What matters is that at the moment of issuance of the permit to locate the nuclear facility, all the requisites required by the Office will have been met. On the contrary, if all the requisites are not met, there is a reason to assume that SONS will not issue a permit to locate the nuclear facility and the project will thus not be executed.

Sections of the documentation

The documentation is divided into sections strictly in compliance with Annexe 4 to Act no. 100/2001 Coll. on Environmental Impact Assessment, as amended by Act nos. 93/2004 Coll., 163/2006 Coll., 186/2006 Coll., and 216/2007 Coll.

Since the outline specified in the Annexe is rather extensive, a brief overview of its contents follows:

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[1] Within the jurisdiction of the Czech Ministry of the Environment.

[2] Within the jurisdiction of the State Office for Nuclear Safety.

Part A contains the identification information on the project applicant (investor).

Part B is divided into multiple subchapters:

- Part B.I contains the basic information on the project, i.e., primarily the basic project design information;
- Part B.II contains information on inputs, i.e., demands on land occupation, media (water and other inputs) consumption, and transport;
- Part B.III contains information on outputs, i.e., emissions into the air, discharges of wastewater and waste generation, noise generation, emissions of radiation, and any other outputs to the environment.

Part C contains information on the current state of the environment in the affected area, and development trends of the state of the environment if any.

Part D contains the resulting characterisation and results of the assessment of the project impacts on the population and the environment. It is divided into multiple subchapters:

- Part D.I contains the characterisation of the impacts on the population and the environment, and an assessment of their size and significance;
- Part D.II contains the characterisation of the impacts on the environment in respect of their size and significance and potential for transboundary impacts;
- Part D.III contains a description of environmental risks during possible accidents and non-standard situations;
- Part D.IV contains a description of measures to prevent, eliminate, reduce or compensate for adverse environmental impacts;
- Part D.V contains a description of the methods used in the prognosis and acquisition of initial assumptions for the environmental impact assessment (methods of elaborating the notification and its components);
- Part D.VI contains a description of lack of knowledge and uncertainties that occurred during the notification development.

Part E contains information on alternative project designs.

Part F contains a summary conclusion.

Part G contains a generally understandable non-technical summary.

Part H contains annexes, i.e., maps, site plans, related studies, or any other materials providing more precise information on the environmental components. It also contains all the other requisites of the documentation.

The documentation structure used is based on requirements of Annexe 4 to Act no. 100/2001 Coll. on environmental impact assessment, including the use of Roman/Arabic numerals in the different heading levels. In order to make navigation within the documentation easier, the numbering is accompanied with colour coding of the levels as follows:

A. Level 1

A.1. Level 2

A.1.1. Level 3

A.1.1.1. Level 4

A.1.1.1.1. Level 5

A.1.1.1.1.1. Level 6

A.1.1.1.1.1.1. Level 7

The recommendations for the documentation reader are based on the extent of information presented in the documentation sections. Readers interested in general information only should read Part G Non-technical Summary, which summarises the documentation conclusions in a concise and understandable way, yet without substantiation of the information quoted. More detailed information can be found in the relevant chapters of the documentation; the reader has to follow its formal division by section and look up the required information in the relevant chapters. More detailed information is quoted in the annexes to the documentation, which only deal with the most significant spheres of the assessment. Finally, the broadest range of information can be found in the numerous materials listed in the Bibliography, and in other materials. However, the reader shall find such materials by themselves; it is not the purpose of the documentation to substitute for them or quote them in full.

Miscellaneous

Although the documentation cannot avoid a certain overlapping of environmental issues (and legislation concerned) with nuclear issues (and legislation concerned), it has been the documentation authors' effort to limit the scope of the documentation particularly to the sphere of its primary subject matter, that is, assessment of all the relevant impacts on the environment. This also concerns the terminology used, which is largely grounded in legislation and customs of the environmental sphere or environmental component sphere.

In the sense of Section 2 of Act no. 100/2001 Coll. on environmental impact assessment, as amended, the scope of the assessment does not encompass an assessment of the work environment (work hygiene conditions) in the project workplaces. In spite of that, a request was made during the ascertainment procedure to make allowance for impacts on the power plant staff. Information concerning that is therefore shown in the documentation, yet it is not the subject of the assessment and is of informative nature only.

Settlement of conditions arising from ascertainment procedure conclusions

The elaboration of this documentation was preceded by an ascertainment procedure pursuant to Act no. 100/2001 Coll. on environmental impact assessment, as amended. The conclusion of the ascertainment procedure, issued by the Ministry of the Environment (ref. no. 8063/ENV/09 of 3 February 2009) and respecting the factual comments made in positions received during the ascertainment procedure, resulted in 35 requirements to be incorporated in the documentation, including 34 explicitly specified and 1 (final) implicitly specified.

The requirements for elaboration of the documentation pursuant to Annexe 4 to the Act are as follows[1]:

Project necessity justification:

Requirement 1:

Make a clear presentation of all relevant information necessary for assessing the justification of the construction of the new power plant, consisting in demonstrating its net benefit to society while taking into account all the relevant and available environmental, social and economic aspects.

Settlement of the requirement:

Information necessary for assessment of the justification of the construction of the new power plant is given in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them (page 86 in this documentation).

Requirement 2:

Quote a scenario that would be a basis for the operator's thinking when justifying the necessity of the power plant and its capacity, including all input parameters and industry information; define an alternative scenario based on a realistic mix of various energy types.

Settlement of the requirement:

Scenarios that are the basis for justification of the necessity of the power plant and its capacity are based on the National Energy Policy of the Czech Republic, the Report of the Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee), and other policy and strategy papers.

Information on these papers is given in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them.

Requirement 3:

When defining scenarios, take into account the potential for renewable sources of energy, particularly in respect to meeting the Czech Republic's goals concerning shares of renewable sources, increasing energy efficiency, increasing energy effectiveness, potential energy savings, etc.

Settlement of the requirement:

Scenarios that take into account the potential for renewable sources of energy, increasing energy efficiency, increasing energy effectiveness, potential energy savings, etc. are included in both the National Energy Policy of the Czech Republic and the Report of Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee).

[1] The numbering of the requirements and their grouping respect the ascertainment procedure conclusion.

Information on these policy papers is contained in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them, specifically subchapter B.I.5.2.2. Project programme framework (page 96 in this documentation).

Requirement 4:

When justifying the necessity of the project, take into account the potential lack of nuclear fuel and the effect of such facts on the economic profitability of the project.

Settlement of the requirement:

Reserves of fission material are dealt with in the Report of the Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee); the issues are also followed closely by the project applicant for clear reasons.

For more details see Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them, specifically subchapter B.I.5.2.2. Project programme framework (page 98 in this documentation).

Technical project design:

Requirement 5:

Make a specific technical and technological description of all the assumed reactor types in the documentation, including process diagrams, and assess the effect of the impacts of each assumed reactor type on the environment and public health, with a special emphasis on the areas defined in the requirements on amending the documentation made below.

Settlement of the requirement:

A specific technical and technological description of all the assumed reactor types is made in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation) and its subchapters. The description is divided into a general part, defining the NNPP project with III and III+ generation PWR units, and a specific part, describing the technical design of the AES-2006 (traded as MIR-1200), AP1000, EPR and EU-APWR units. These units are the model alternatives of the possible design; the first two are units of capacity approximately 1200 MW_e and the other two approximately 1700 MW_e.

The impacts of each assumed reactor type on the environment and public health are assessed in Chapter D.I. DESCRIPTION OF EXPECTED PROJECT IMPACTS ON THE POPULATION AND THE ENVIRONMENT AND ASSESSMENT OF THEIR EXTENT AND SIGNIFICANCE (page 372 in this documentation), and its subchapters.

Requirement 6:

Based on a comprehensive assessment of all the assumed reactor types, compare the impacts, including potential, of the reactors on the environment and public health, and rank the reactor types with respect to that.

Settlement of the requirement:

The impacts of all the assumed reactor types are compared in Chapter PART E - COMPARISON OF PROJECT DESIGN ALTERNATIVES (page 542 in this documentation), which also defines the ranking order of the reactor types. However, both the model alternatives of the completion project using the lower capacity units (approximately 1200 MW_e) and those using the higher capacity units (approximately 1700 MW_e) assume the same PWR reactor type, which logically leads to qualitatively identical environmental impacts.

Requirement 7:

Make a technical examination and assessment of the possibility to use part of the capacity of the new power plant for production of hydrogen as an alternative fuel.

Settlement of the requirement:

Technical information and assessment of the possibility of using the power plant capacity for production of hydrogen are examined and assessed in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them, specifically subchapter B.I.5.2.2. Project programme framework (page 98 in this documentation).

Requirement 8:

Clearly define a zero alternative and assess its impact on the environment and public health.

Settlement of the requirement:

The zero alternative is defined in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them, specifically subchapter B.I.5.2.3. Zero alternative (page 121 in this documentation).

The zero alternative is the non-execution of the project, i.e., not building the new nuclear power source at the Temelín site including power output to Kočín switchyard.

The description of the impacts of the zero alternative on the environment and public health is included in Chapter C.2.DESCRIPTION OF THE CURRENT STATE OF THE ENVIRONMENT IN THE AFFECTED AREA (page 223 in this documentation), dealing with a description of the state of the environmental components and public health in the affected area and their development trends. The zero alternative thus includes the operation of the existing power plant (units 1 and 2).

Requirement 9:

Describe the entire design cycle of the nuclear power plant, with an emphasis on disposing of the facility.

Settlement of the requirement:

A description of the complete design cycle of the nuclear power plant, including the disposal of the facility, is made in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation) and its subchapters.

The documentation describes and assesses both the power plant operation (being the primary subject matter of assessment) and its construction and decommissioning later on. Speaking of which, the termination of the project operation is perceived by both Act no. 100/2001 Coll. on environmental impact assessment and Act no. 18/1997 Coll. (Atomic Act) as a separate project for which an environmental impact assessment is required prior to the issuance of a decommissioning permit.

The decommissioning of the project will therefore be subject to a separate environmental impact assessment at the appropriate time. It is therefore assessed in this documentation up to the level of knowledge currently available, which is necessarily of a policy or a strategic, rather than specific, nature especially given the distant time horizons.

Accumulation of impacts:

Requirement 10:

Include in the documentation buildings and process units directly associated with the project without which the project cannot be operated; these include, in particular, the power output from Kočín switchyard, especially the new 400 kV line Kočín - Mírovka, widening of the transport routes in connection with the transporting of oversized components, the spent fuel repository, and the hot water delivery pipeline for České Budějovice, estimate their impacts on the environment and public health, including potential impacts, also in connection with the possible accumulation and synergies of their effects with the project.

Settlement of the requirement:

The notified project, thus the subject matter of the documentation, is the new nuclear power plant in Temelín, including power output to the Kočín switchyard. Other buildings or process units are not part of the project.

The subject matter of the project is power output to the Kočín switchyard, which is part of the Czech Republic's power distribution system. The 400 kV and 220 kV power distribution system is managed by ČEPS, a.s., which is responsible for the operation and development of the system. The development of the new double 400 kV line Kočín - Mírovka, upon which the completion of the Temelín Power Plant is conditioned, is therefore an investment of ČEPS, a.s; its utilisation is not singly derived from the transmission of power from Temelín Power Plant - it is a functional component of the entire Czech Republic's power distribution system. The power line development preparation includes an environmental impact assessment, as Act no. 100/2001 Coll. on environmental impact assessment defines it as a separate project subject to assessment (Category I, item 3.6 of Annexe 1 to the Act).

Requirements on transport routes in connection to the project construction and assessment of their impacts on the environment are included in the documentation. Information on the transport routes is included in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.10. Construction data. The assessment of these impacts is made in Chapter D.I. DESCRIPTION OF EXPECTED PROJECT IMPACTS ON THE POPULATION AND THE ENVIRONMENT AND ASSESSMENT OF THEIR EXTENT AND SIGNIFICANCE (page 372 in this documentation), and its subchapters focusing on the environmental components, which also deal with impacts during the construction.

The spent fuel repository will not be required when the project is put into operation. Spent, or irradiated fuel will be stored in pools by the reactor, the capacity of which will be sufficient for at least ten years operation of the new units. The repository will therefore be prepared as a separate investment project to make it available when needed. Its development preparation will include an environmental impact assessment, as Act no. 100/2001 Coll. on environmental impact assessment defines it as a separate project subject to assessment (Category I, item 3.5 of Annexe 1 to the Act). That way it will reflect the current stage of knowledge, technical quality of the repository and state of the environment in the affected area at the time of its preparation.

The hot water distribution pipeline for České Budějovice was originally prepared as part of the construction of the existing Temelín Power Plant, but was never executed. The pipeline was only built to Týn nad Vltavou, but the capacity of the heat evacuation engine house situated within the power plant makes it possible to connect České Budějovice as well. The project permits the utilisation of the waste heat (construction of the hot water pipeline to České Budějovice) but does not require it. The execution of the project is not conditioned upon it. Nevertheless, the potential hot water pipeline to České Budějovice would make use of the heat evacuation capacity of the existing units (1 and 2). Also in light of that, it is not the subject matter of the project (units 3 and 4). In case its execution is opted, it would be subject to an environmental impact assessment pursuant to Act no. 100/2001 Coll. on environmental impact assessment (Category I and II, item 3.7 of Annexe 1 to the Act).

Requirement 11:

Assess the component impacts on the environment and human health not only separately for the new nuclear power plant but in accumulation of impacts with the operation of NPP Temelín.

Settlement of the requirement:

The documentation firstly deals with assessment of the impacts of the project as such (i.e., units 3+4 including related structures and process units), and secondly with assessment of the impacts of the entire Temelín Power Plant including the project (i.e., units 1+2+3+4 including related structures and process units).

The information is given and the impacts are assessed in two basic aspects: the first aspect is relative (encompassing the new plant project only); the other aspect is absolute (encompassing the entire power plant after the new plant is built). This approach to the assessment and quoting of information is employed wherever information on the project as such and on the power plant after the extension has to be or should be differentiated. It is therefore employed in Chapters B.II. INFORMATION ON INPUTS (page 185 in this document), B.III. INFORMATION ON OUTPUTS (page 198 in this document), and D.I DESCRIPTION OF

EXPECTED PROJECT IMPACTS ON THE POPULATION AND THE ENVIRONMENT AND ASSESSMENT OF THEIR EXTENT AND SIGNIFICANCE (page 372 in this documentation).

The relative assessment aspect is the subject matter of the documentation; the absolute aspect is then used in the majority of cases, where it is necessary or desirable to specify demands or impacts of the power plant in its total effect.

Safety and public health:

Requirement 12:

Define the quantity of the assumed radioactive inventory in the entire facility (taking into account the spent nuclear fuel repository).

Settlement of the requirement:

Information on the radioactive inventory is given in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.5. Operational design data.

Requirement 13:

Describe the project in the following spheres: safety concept and basic safety criteria, geological, hydrogeological and seismological conditions in the area, protective envelope (containment) and other structures relevant to safety, principle of depth protection, principle and concept of safety systems, description of safety-relevant components, accident requirements, concept of handling spent nuclear fuel, radioactive waste handling system, radioactive discharges, nuclear safety provisions, detailed definition of safety standards, end of operation concept (including assessment of radiation impacts and other impacts of the chosen method on the environment).

Settlement of the requirement:

The required information is given in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), subdivided into subchapters. The description of the technical (technological and structural) design also focuses on safety aspects in the extent proportionate to the requirements of the ascertainment procedure and goals of EIA documentation.

The geological, hydrogeological and seismological conditions in the area are then discussed in more detail in Chapter C.2. CHARACTERISATION OF THE CURRENT STATE OF THE ENVIRONMENT IN THE AFFECTED AREA (page 223 in this documentation); safety issues in Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).

Requirement 14:

Based on the above description of safety characteristics, assess the capacity of the facility to withstand various potential external threats (fall of various types of aircraft, terrorist attack, etc.).; assess the likelihood of such occurrences particularly in respect of aviation and road traffic around the facility and the operation of the pipeline.

Settlement of the requirement:

The required information is contained in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.4.Structural design data.

The required minimum resistance of the facility to various potential threats is derived from the risk analysis of potential external impacts, the occurrence of which in the area with a non-negligible probability can be assumed. The results of the analysis have been reflected in the assignment documentation, which is a basis for the elaboration of bids, and will further be documented in the Assignment Safety Report in an extent necessary for assessing the compliance of the project with the executive regulation to the Atomic Act (no. 18/1997 Coll.) that specifies criteria for locating nuclear facilities (SONS Decree no. 215/1997 Coll.).

The project preparation timetable assumes the State Office for Nuclear Safety to first assess, as part of the project location permit procedure, the appropriateness of the Temelín site for the location of PWR-type units, the resistance of which to external impacts complies with requirements on generation III or III+ units; allowance will be made for the MoE position. The ensuing administrative procedures will only commence after the assessment of the bids and submission of contractor documentation for a detailed technological and structural design of the project. The assessment of the compliance of the particular design with legislative requirements, including requirements on resistance to external impacts, will be included in the development permit documentation.

The units that are the subject matter of the project are sufficiently resistant to impacts expectable in European Union countries. A definitive proof of resistance, related to the conditions at the Temelín site, has to be submitted by the selected contractor for the technology and the building; failing that, the project shall not be executed.

Requirement 15:

Assess impacts of not only normal operation, but also design basis and beyond design basis accidents and serious accidents of the nuclear facility (in particular, predict the probability of failures and accidents, describe assumed accident scenarios, assess source terms); based on that assessment, proceed to design the extent of the emergency preparedness zone so that it is sufficient and demonstrable, with respect to both the new power plant and the spent fuel repository; follows the same steps for the external emergency plan.

Settlement of the requirement:

Emergency preparedness issues are dealt with in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.9. Emergency preparedness data.

Impacts of design basis and beyond design basis failures and serious accidents are dealt with in Chapter D.III.DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).

The subject matter of the project is the construction of a nuclear power plant with safety parameters pursuant to the EU requirements, which is a guarantee that the emergency planning zone (EPZ) will not have to be extended, and the related external emergency plan will not have to be reworked. It follows from the project parameters that in its documentation it is obliged to submit to the State Office for Nuclear Safety pursuant to Section 1 of Government Regulation no. 11/1999 Coll., ČEZ, a.s., does not consider designing a larger EPZ than within approximately 3 km of the new units, that is, within an area smaller than the existing zone. However, definition of the EPZ is within the powers of SONS; the update of the external emergency plan is within the powers of the Fire Rescue Service. The EIA documentation therefore cannot interfere with the powers of these authorities and presume their decisions.

Requirement 16:

Present an analysis that will consider not only the impacts of an accident on the specified location and its immediate vicinity, but will make a quantitative picture of the potential radiation exposure of the population and the likelihood of its occurrence in the borderlands of neighbouring countries.

Settlement of the requirement:

Effects of the impact of accidents and related radiation exposure (including an assessment of borderlands of neighbouring countries) are dealt with in Chapter D.III.DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).

Requirement 17:

Elaborate an assessment of the impacts of the project on the health of the population, which shall be based, among other things, on the current results of environmental impact monitoring, and consider impacts on the nuclear power plant staff.

Settlement of the requirement:

The assessment of the impacts of the project on the health of the population is contained in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation). The assessment is based, among other things, on the results of monitoring of the environment and health of the population in the affected area, the results of which are commented on in Chapter C.2.1. Population and public health (page 223 in this documentation).

Impacts on the power plant staff are reflected in Chapters C.2.1. Population and public health (page 223 in this documentation) and D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation). Assessment of impacts on the staff (occupational hygiene issues) is handled in accordance with the applicable legislation by the respective sanitary inspection bodies (non-radiation impacts) possibly by the State Office for Nuclear Safety (radiation impacts); the information shown in this documentation is therefore only of an informative nature.

Requirement 18:

Design a monitoring system for the health of the population and a scope of the monitoring; design a method of informing the population and representatives of municipalities about results of the monitoring.

Settlement of the requirement:

The health of the population in the affected area has been monitored for a long time; it is assumed to continue after the project execution by reason of continuity of the data series.

The results of the monitoring and the method of informing the public thereof are commented on in Chapter C.2.1. Population and public health (page 223 in this documentation).

Spent fuel and waste:

Requirement 19:

Determine the types and quantities of waste generated during the facility operation in accordance with the terminology of the Czech legal system; classify radioactive waste by the size of its radioactivity.

Settlement of the requirement:

The types and amounts of waste generated are specified in Chapter B.III. INFORMATION ON OUTPUTS, specifically its subchapters B.III.3. Waste (page 204 in this documentation), which deals with inactive waste, and B.III.4. Others (page 208 in this documentation), which deals with radioactive waste.

Requirement 20:

Determine the quantity of spent nuclear fuel.

Settlement of the requirement:

The quantity of spent nuclear fuel is determined in Chapter B.III. INFORMATION ON OUTPUTS, specifically its subchapter B.III.4. Others (page 208 in this documentation).

Requirement 21:

Assess the method of handling waste (especially highly radioactive) and spent fuel.

Settlement of the requirement:

The method of handling waste is described in Chapter B.I.6.5. Operational design data (page 173 in this documentation).

Impacts resulting from waste handling are assessed in Chapter D.I.11. Other environmental impacts (page 515 in this documentation).

Requirement 22:

Present a method for safe disposal of nuclear fuel, including documentation for the deep repository construction site.

Settlement of the requirement:

The method of handling spent fuel is described in Chapter B.I.6.5. Operational design data (page 173 in this documentation).

The State guarantees the safe deposition of radioactive waste (pursuant to Act no. 18/1997 Coll., the Atomic Act). The Radioactive Waste Repository Administration (RAWRA), an organisational component of the State, is established for this purpose. The RAWRA subject matter is defined in Section 26, paragraph 3 of Act no. 18/1997 Coll., the Atomic Act, and includes (among other things) preparation, construction, commissioning, operation and shutdown of nuclear waste repositories and monitoring of their impacts on their surroundings. The deep repository is therefore being prepared by the state organisation RAWRA, including the finding of a suitable site.

Government Resolution no. 487/2002 of 15 May 2002 passed the Strategy for Handling Radioactive Waste and Spent Nuclear Fuel. The Strategy defines the long-term national policy in the area; it rules the preparation of a deep repository for highly active waste and spent nuclear fuel; it should be put into operation in 2065. Until then, spent nuclear fuel from nuclear power plants will be stored in the transport-storage packaging assemblies (containers), situated in separate repositories inside nuclear power plants.

At the time of elaboration of this documentation, it is therefore not possible to document the final site for the construction of a deep repository in accordance with the adopted Strategy.

RAWRA is working on selecting suitable sites for the location of the deep repository. The stage of assessment of the territory of the Czech Republic, using comprehensively defined requirements, was completed in 2003. Based on the assessment, six relatively more suitable sites were short-listed for the next stage of preparation. The sites are known under the working titles of Lubenec - Blatno (Ústí Region), Budišov (Vysočina Region), Pačejov (Plzeň Region), Rohozná (Vysočina REgion), Pluhův Žďár - Lodhéřov (South-Bohemian Region), and Božejovice - Vlksice (South-Bohemian Region). Basic geophysical measurements were then conducted on the above sites in 2003; they made it possible to narrow down the territorial scope for detailed geological surveys. In 2006, the proposed sites were included in the Territorial Development Policy of the Czech Republic (passed by Government Resolution no. 561 of 17 May 2006). In 2008, the Territorial Development Policy was updated (passed by Government Resolution no. 929 of 20 July 2006), including a partial amendment to the section concerning selection of sites for the deep repository, setting a task to select the two most suitable sites for the building of a deep repository by 2015 with the involvement of the affected municipalities. As part of assessing the territory of the Czech Republic in respect of a possible location for the deep repository, in accordance with the timetable approved by the Government in 2008 (Government Resolution no. 1315 of 20 Oct 2008), RAWRA is also examining the territories of military zones in which the relevant geological criteria may be met. The results of the first stage of these surveys indicate that the requirements could be met in the military zones of Boletice and possibly Hradiště.

More detailed information can be found on the RAWRA website (www.surao.cz, www.rawra.cz).

Transportation:

Requirement 23:

Assess transportation conditions during the construction and operation of the new unit, including a definition of transport corridors for both transportation of construction materials and process components and transfers of radioactive waste for potential reprocessing; consider potential transboundary effects.

Settlement of the requirement:

Transportation requirements during the project construction and operation are described in Chapter B.II.4. Demands on transport and other infrastructures (page 192 of this document). The condition of the transport infrastructure in the affected area is described in Chapter C.2.10. Transport and other infrastructures (page 364 of this document); impacts on the transport infrastructure in Chapter D.I.10. Impacts on transport and other infrastructures (page 510 of this document).

The Government approved Policy of Radioactive Waste Management and Spent Fuel Management does not assume transfers of radioactive waste for reprocessing; the basic national strategy in the spent nuclear fuel management is long-term storage and subsequent reposition in a deep repository. Transboundary impacts due to transport are therefore not relevant at the moment.

Requirement 24:

Propose measures to mitigate impacts on the environment due to transport; prefer the utilisation of the railway network.

Settlement of the requirement:

The Temelín Power Plant site has a railway siding, meaning railway transportation is a feasible alternative using the free capacity of the Čížcenice - Temelín railway line. The required measure is specified in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).

Requirement 25:

Document the sufficient capacity and functional utilisation of roads used for potential evacuation of the population.

Settlement of the requirement:

Information on the sufficient capacity and functional utilisation of roads used for potential evacuation of the population is given in Chapter C.2.10. Transport and other infrastructures (page 364of this document), specifically its subchapter C.2.10.1.1. Road transport.

Population evacuation from the emergency planning zone is described in detail in the External Emergency Plan for the Temelín Nuclear Power Plant.

Groundwater and surface water:

Requirement 26:

Complete the balance of all the water utilised, and clearly assess the impact of the consumption of surface water on flow rates in the Vltava (even for the case of its assumed navigability), including the dam reservoirs, for various hydrological conditions (considering potential climate change); document the provision of sufficient water for the functioning of the nuclear power plant with a significant impact of the riverine ecosystems.

Settlement of the requirement:

Balances of water used (water consumption and wastewater generation) are made in Chapters B.II.2. Water (page 188 in this documentation), and B.III.2. Wastewater (page 200 in this documentation).

The hydrological conditions in the Vltava are described in Chapter C.2.4. Surface water and groundwater (page 298 in this documentation).

The impacts on the hydrological conditions in the Vltava are quantified in Chapter D.I.4. Impacts on surface waters and groundwater (page 449 in this documentation); the impacts on the riverine ecosystems in Chapter D.I.7. Impacts on fauna, flora and ecosystems (page 468 in this documentation).

Requirement 27:

Provide the quantities of wastewater discharged into the water body, including a clear definition of its chemical and physical composition, focusing above all on all the potential radionuclides; assess the impact of the wastewater discharged on the environment and public health, including consideration of long-distance transfer beyond the boundaries of the Czech Republic; propose specific measures to prevent, eliminate, reduce or compensate for adverse impacts.

Settlement of the requirement:

The amount of wastewater discharged into the water body is quantified in Chapter B.III.2.Wastewater (page 200 in this documentation), including the specification of its chemical and physical composition. Information on the radionuclides in the wastewater is provided in Chapter B.III.4. Others (page 208 in this documentation), which provides summary information on the radioactive outputs (in accordance with the outline of Annexe 4 of Act no. 100/2001 Coll.).

The assessment of the impacts of the wastewater discharged on the environment and public health is part of the assessment of impacts on environmental components made in the respective subchapters of Chapter D.I. DESCRIPTION OF EXPECTED PROJECT IMPACTS ON THE POPULATION AND THE ENVIRONMENT AND ASSESSMENT OF THEIR EXTENT AND SIGNIFICANCE (page 372 and subsequent in this documentation), which also considers the potential long-distance transfer across the boundaries.

A proposal of specific measures to prevent, eliminate, reduce or compensate for adverse impacts is made in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).

Requirement 28:

Assess the impact on groundwater with respect to the already existing disruption of the shallow circulation by the existing power plant.

Settlement of the requirement:

The impact on groundwater is assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation).

Fauna, flora and ecosystems and landscape character:

Requirement 29:

Conduct a biological survey and assess the impact of the project (including the impact of increased temperature of the receiving water body) on the flora, fauna and ecosystems, with respect to any presence of specially protected species and their biotopes; based on the biological survey, propose specific measures to prevent, eliminate, reduce or compensate for averse impacts on the flora, fauna and ecosystems; consider aquatic ecosystems.

Settlement of the requirement:

The documentation includes a biological survey, including an assessment of the project impacts on flora, fauna and ecosystems, including with respect to any presence of specially protected species and their biotopes. These impacts are assessed in Chapter D.I.7. Impacts on fauna, flora and ecosystems (page 468 in this documentation).

Specific measures to prevent, eliminate, reduce or compensate for adverse impacts on the flora, fauna and ecosystems (including aquatic ecosystems) are made in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).

Requirement 30:

Assess the project impacts on the landscape character.

Settlement of the requirement:

Impacts of the project on the landscape character are assessed in Chapter D.I.8. Impacts on landscape (page 500 in this documentation).

Climate and air:

Requirement 31:

Determine the size and extent of the change in weather and microclimate due to the emissions of heat and water, in particular, from the cooling towers, and assess the impacts of such changes on the ecosystems in the affected area; propose measures to reduce the release of water vapour into the air, or utilise its calorific potential.

Settlement of the requirement:

The size and extent of the change in weather and microclimate due to the emissions of heat and water from the cooling towers are assessed in Chapter D.I.2.Effects on the air and weather (this document, page 396). The impacts of the changes on the ecosystems in the affected area are assessed in Chapter D.I.7. Impacts on fauna, flora and ecosystems (page 468 in this documentation).

The cooling towers will be fitted with effective droplet drift eliminators. Factual measures to utilise the calorific potential will be taken at the cooling system input, not output. In effect, this means the units will be executed with maximised efficiency of the transformation of thermal energy to electric energy, minimising the waste heat discharge.

Requirement 32:

Make a detailed description of all the emissions (especially radionuclides) released into the air, and determine their assumed quantities; include long-distance transfers beyond the national boundaries; propose specific measures to prevent, eliminate, reduce or compensate for adverse impacts.

Settlement of the requirement:

The inactive emissions into the air are described in Chapter B.III.1. Air (page 198 in this documentation); the radioactive emissions into the air (discharges into air) are described in Chapter B.III.4. Others (page 208 in this documentation).

The impacts on air in non-radiation characteristics are described in Chapter D.I.2. Impacts on the air and climate (page 396 in this documentation); in radiation characteristics, in Chapter D.I.11. Other environmental impacts (page 515 in this documentation). The assessment includes impacts on transboundary territories.

Specific measures to prevent, eliminate, reduce or compensate for adverse impacts are made in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).

Requirement 33:

Analyse indirect greenhouse gas emissions from the nuclear power plant for its entire design cycle.

Settlement of the requirement:

Information on indirect greenhouse gas emissions from the nuclear power plant and their comparison with greenhouse gas emissions from other energy sources are contained in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them, subchapter B.I.5.2.2. Project programme framework, subsection B.I.5.2.2.8. Greenhouse gas emissions (page 119 in this documentation).

Social aspects:

Requirement 34:

Assess the impact on tourism in the affected area; assess the impact on the employment and civic development in the surroundings of the project.

Settlement of the requirement:

The impacts on tourism, employment and civic development are assessed in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation).

Other requirements:

Requirement 35:

Moreover, the documentation has to clearly consider and settle all relevant requirements for additions, comments and requirements contained in positions received.

Settlement of the requirement:

Requirements for additions, comments and requirements contained in positions received are not explicitly specified in the conclusions of the ascertainment procedure. They follow implicitly from the positions received. Their settlement is therefore also mostly handled implicitly and follows from the relevant documentation chapters.

Consideration and settlement of requirements for additions, comments and requirements does not necessarily imply an unconditional agreement with their relevance to the subject matter of the documentation or their wording. Quite to the contrary, a number of these comments are settled in a disapproving way; such an approach is always justified.

The summary of comments contained in positions received and the method of their settlement are shown in the table below.

Project necessity justification:
35.1. Request to break the bounds of alternatives to the “New nuclear power plant” always based on a single fuel or source, whether it is coal, gas and oil or the sun, biomass, wind, water and geothermal energy; a realistic mixed scenario with all these sources and increasing their utilisation efficiency, consumption management, etc., is missing.
The project is the development of a new nuclear power plant, the potential alternatives are therefore related to that project. The project is then a component of a broader programme framework, which contains a mixed scenario with various sources. However, they are not a direct alternative to the project; the choice of the programme framework is not in the direct jurisdiction of the project applicant, and it is the subject of national or other strategies. For more information, see Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.2. Request to consider combined heat and power units; in this respect, the actual expectable increase in consumption should be identified while reducing electrical heating systems and deploying innovative heating systems and power generation systems connected with energy redevelopment of old buildings, and the necessity for a nuclear power plant should be reviewed.
Information on the expected consumption trend, considering various sources of electricity, sources of primary energy and savings potential is given in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.3. Request to assess the energy necessity of a power plant capacity of 3400 MW; base the assessment on realistic scenarios that consider measures focused on increasing energy efficiency on both production and consumption sides and the required increase in utilisation of renewable sources of energy.
The justification of the necessity of the project and the assumed scenarios are given in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them (page 86 in this documentation); specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.4. Consider the potential for savings and increasing energy efficiency with respect to the Czech Republic's and EU energy policy and the EU Energy Efficiency Directive.
Information on the expected consumption trend, considering various sources of electricity, sources of primary energy and savings potential is given in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.5. Adjust the alternative design to the expected consumption (considering increasing energy efficiency).
Information on the expected consumption trend, considering various sources of electricity, availability of sources of primary energy and savings potential is given in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.6. Assess the impact of partial reduction in electricity exports in favour of domestic use of existing sources on the necessity to build a new source of electricity.

The purpose of the project is substitution for domestic coal power plants near the end of their useful life as specified in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation). It is therefore not intended for export purposes. The balance of the Czech Republic's trade in energy sources is deeply negative. The excess capacity in the power distribution system that was generated by the commissioning of Temelín Power Plant units, and was nearly 20% of the gross electricity production, is very rapidly being exhausted due to the decommissioning of existing power plants and the average annual increase in electricity consumption in the Czech Republic by 1.95%. This trend is not reversed even by the most conservative predictions of electricity consumption decreases (considering the deepest implications of the crisis).
35.7. Extend the alternative design with a scenario comprising multiple energy sources (including energy efficiency) that will rely on exploitation of realistic potentials in the domain of renewable sources of energy.
Information on the expected consumption trend, considering various sources of electricity, sources of primary energy and savings potential is given in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.8. Disapproval with the fact that alternatives are to be designed based on a model posed by an oversized project.
Information on the expected consumption trend, considering various sources of electricity, sources of primary energy and savings potential is given in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation). They indicate that the alternatives that are the subject matter of this documentation cover the demand for electric energy and substitute for domestic coal power plants near the end of their useful life.
35.9. Requirements on refinement and reworking of the alternatives to the nuclear power plant, including a detailed description of the real potential of renewable sources of energy.
Information on the expected consumption trend, considering various sources of electricity, sources of primary energy and savings potential is given in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation). The same section provides information about the potential of renewable sources.
35.10. Request for a concise overview of all relevant information necessary for assessing the justification of the construction of a new nuclear power plant in compliance with Section 4, paragraph 2 of the Atomic Act; the justification of the construction of a new power plant consists in proving its net benefit to society while considering all relevant and available economic and social aspects; it does not consist in a mere enumeration and demonstration of the preponderance of advantages identified of one alternative over another, and cannot be solely based on an expression of the current political or social demand.
Information necessary for assessment of the justification of the construction of the new power plant in compliance with §4, Para 2 of the Atomic Act is given in Chapter B.I.5.1. Justification of the project necessity and location (page 86 in this documentation).
35.11. Disagreement with the claim that nuclear energy is independent of external resources from unstable regions in light of the limited opportunities to extract uranium in the Czech Republic.
There is a quotation from the National Energy Policy of the Czech Republic; the verbatim wording is as follows: "[...] The nuclear energy sector will also support the priorities of maximising the nation's independence on sources of energy from risky areas and maximising the nation's independence on reliability of supplies of foreign energy sources. Fuel for nuclear power plants can be obtained on markets in politically stable areas and its stocks can be generated and maintained over very long periods of time."
35.12. Objection against a biased selection of information for the opening pages of the notification, which was to justify the construction of a new nuclear power plant and make the impression that it is an absolutely inevitable solution.
The project notification includes Chapter 5. Justification of the project necessity ... (page 14 in the notification), where information on justification of the project belongs and where it is quoted as should be. Its selection for the opening of the notification is merely for informative purposes.
35.13. Issues of economic profitability of nuclear power plants.
This goes beyond the scope of the documentation: economic issues are not the subject matter of an environmental impact assessment. The final report by the Pačes Commission says, however, (1) In a broad range of future scenarios, nuclear energy is the cheapest alternative in centralised electricity generation for the base load; (2) The nuclear power industry can be funded without governmental subsidies.
35.14. Considered is the economic comparison the production costs of the reactor and the entire design cycle from designing to construction and operation of the facility to its disposal and intermediate storage and reposition of all the radioactive waste.
This goes beyond the scope of the documentation. Economic issues are not the subject matter of an environmental impact assessment.
35.15. Doubts concerning the preference to a nuclear power plant, especially in connection with the South-Bohemian Region Energy Policy, which quantifies the overall societal benefit as negative.

The territorial energy policy of the South-Bohemian Region focuses in particular on regional energy policy issues and contains an assessment of external conditions for development of energy infrastructures, an analysis of the status quo, a forecast of the development of the region and the external conditions, alternatives for the development of energy infrastructures (in 4 alternatives - reference zero change scenario, spontaneous development scenario, mini guided development scenario, and maxi guided development scenario) and a draft of energy management. Programmes proposed in the energy policy are in the form of executions and support: education and training, reducing nominal consumption in building heating, use of thermo-solar systems, energy use of biomass, construction of passive houses, heat recovery, combined heat and power production, use of hydraulic energy, use of wind energy, and use of solar power. Programmes are expected to be funded by their proponents; priority programmes should be funded by means of multiple-source financing. The policy includes an environmental impact assessment and a multi-criteria assessment of the alternatives of development of energy infrastructures. The recommended alternative is in agreement with the conclusions of the assessment. Temelín Power Plant is a national-level power plant, which makes no claims for funding through support earmarked for the South-Bohemian Region. The South-Bohemian Region Energy Policy only deals with the power plant marginally and its conclusions are not related to Temelín Power Plant.
35.16. Electricity consumption in relation to the development and, first of all, modernisation of the economy; energy saving potential.
Information on the expected consumption trend, considering various sources of electricity, sources of primary energy and savings potential is given in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.17. Make a clear justification of the necessity of the project, especially in comparison with the applicant's current export balance, on which the choice of alternative designs is based.
The justification of the project necessity is made in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them (page 86 in this documentation).
35.18. Request to include a scenario with all input parameters and information that would form the basis for the operator's thinking.
Matches Requirement 2: Scenarios that are the basis for justification of the necessity of the power plant and its capacity are based firstly on the National Energy Policy of the Czech Republic, and secondly on the Report of Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee). Information on these strategic papers is given in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them, specifically subchapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.19. Document the necessity of the project using current development forecasts; include the Czech Republic's goals concerning the target share of renewable energies, implementation of the EU End User Energy Efficiency Directive, and goals in climate protection.
The justification of the project necessity is made in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them (page 86 in this documentation).
35.20. Request to discuss and evaluate the threat of lack of uranium and include it in the efficiency calculations in light of the growing prices and decreasing availability of nuclear fuel.
Matches Requirement 4: Reserves of fission material are dealt with in the Report of Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee); the issues are also followed closely by the project applicant for clear reasons. For more details see Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them, specifically subchapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.21. Request for transparent presentation of the necessity of the project in question in light of the current excess power capacity; take into account an alternative scenario based on increasing energy efficiency.
The justification of the project necessity is made in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them (page 86 in this documentation).
35.22. Request to add references, contents and methodologies for the forecasts of increasing electricity consumption made in the notification.
The notification quotes information from the National Energy Policy of the Czech Republic. In contrast to the notification, this documentation also contains information from the Report of Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee), and other additional information. More detailed information on these strategic papers can be found in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.23. Absence of an alternative scenario built upon increasing energy efficiency in light of the Czech Republic's and EU energy policies.
An alternative scenario built upon increasing energy efficiency is discussed in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.24. Issues of territorial development policy and the SEA process on the National Energy Policy.

The Territorial Development Policy of the Czech Republic (2008) has been elaborated at the time of writing this documentation. The Territorial Development Policy is a land use planning tool, and pursuant to Section 31 of Act no. 183/2006 Coll., the Building Act, which sets out requirements and frameworks for general land use planning tasks in a broader (national and international) context and defines coordination and framework tasks for associated land use planning activities (territorial development principles) and drafting of policies. It is thus not a “national-level land use planning documentation” that would deal with component projects in detail. It is essentially a departmental policy that is not superior to other national-level documents. The Territorial Development Policy (2008) includes an environmental impact assessment on which the Ministry of the Environment issued a disapproving opinion on 23 January 2009. The Territorial Development Policy was passed by Government Resolution no. 929 of 20 July 2009. The National Energy Policy of the Czech Republic received a disapproving opinion from the Ministry of the Environment on 12 December 2003 (pursuant to Act no. 244/1992 Coll.). The Policy was passed by Government Resolution no. 211 of 10 March 2004. The above cases were decisions of the Government, that is, a collective body of which the MoE is a member. In such cases, the body's decision is binding on its members.
35.25. National Energy Policy issues.
The National Energy Policy of the Czech Republic was approved by Government Resolution no. 211 of 10 March 2004. It is one of the groundworks for the elaboration of this documentation, not the subject matter of its assessment. More information on the National Energy Policy is provided in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.26. The need to consider risks associated with the long-term construction of the power plant; critical reflection of considerable delays in completion of nuclear power plants and exceeding of construction budgets.
This goes beyond the scope of the documentation. Economic issues are not the subject matter of an environmental impact assessment; the said risks are the project applicant's economic risks.
35.27. Request for a description of the age structure of the power plant fleet and a scenario of decommissioning of power plants until 2030, which was the basis for the forecasts.
Information on the structure of the power plant fleet and availability of primary sources for their supplies is provided in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.28. Request for transparent scenarios that reflect both the development in power generation and the development of demand.
Information on the expected generation and demand trends, considering various sources of electricity, sources of primary energy and savings potential is given in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.29. Mention all the counterproductive aspects of a nuclear power plant - environmental protection from contamination with radioactive substances, disruption of balance between different conventional electricity sources, promotion to centralisation of the energy system thus increasing the risk of its instability and reducing reliability of power supplies, etc.
The subject matter of the environmental impact assessment is environmental protection aspects, and the documentation deals with all relevant impacts, including radiation impacts. Technical aspects are beyond the scope of the environmental impact assessment; they are described in the documentation (Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), but they are not assessed. More information can be found in Chapter B.I.5.2. Overview of alternatives considered (page 96 in this documentation), specifically subsection B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.30. Request to postpone the elaboration of the EIA, or make a parallel assessment of the realistic alternative savings - RSE - domestic coal - natural gas - (existing nuclear power plant).
The deadline for the EIA process matches the deadlines for the investment preparation of the project. Issues of savings, renewable sources of energy, domestic coal, natural gas, and existing nuclear power plants are discussed in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.31. Advantages/disadvantages of nuclear power in relation to CO_2 production associated with construction of nuclear power plants and production of uranium fuel cells.
Matches Requirement 33: Information on indirect greenhouse gas emissions from the nuclear power plant and their comparison with greenhouse gas emissions from other energy sources are contained in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them, specifically subchapter B.I.5.2.2. Project programme framework (page 51 in this documentation).
35.32. Request to build a larger number of smaller power generating facilities instead of a “megaproject”.
A comparison of potentials of various power facilities is made in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
Technical project design:
35.33. Request for a specific technical and technological description of assumed reactor types, including process diagrams, and a specific description and assessment of their environmental impacts.
Matches Requirement 5. A specific technical and technological description of all the assumed reactor types is made in Chapter B.I.6. Description of the project technology and technological design (page 121 in this documentation); the impacts of each assumed reactor type on the environment and public health are assessed in Chapter D.I. DESCRIPTION OF EXPECTED PROJECT IMPACTS ON THE POPULATION AND THE ENVIRONMENT AND ASSESSMENT OF THEIR EXTENT AND SIGNIFICANCE (page 372 in this documentation).
35.34. Request to add a description of the whole design cycle of the nuclear power plant with an emphasis on the disposal of the facility and storage of nuclear waste.

Matches Requirement 9: A description of the complete design cycle of the nuclear power plant, including the disposal of the facility, is made in Chapter B.I.6. Description of the project technical and technological design (page 60 in this documentation) and its subchapters.
35.35. Request to assess the impacts of a real, specific facility, the properties of which have been documented and proven, not a virtual facility certain properties of which are merely assumed.
For about 50 years, nuclear power plants have been the reality, not a virtual reality. At the time of writing the project notification, a total of 265 units with PWR-type reactors were in operation, providing a total installed capacity of approximately 243 GW_e. That constitutes a sufficient experience and information base for an expert estimate of impacts of the new units of a similar (albeit more modern and safer) structure, with the operation of which there have been no practical experience so far. If we only permitted the construction of units, the properties of which can be documented on operational data, we would preclude the application of scientific and technical results to the detriment of increased efficiency and safety of the installations. The only rational attitude is thus based on proofs made as part of a licensing procedure assessed by competent state administration supervisory bodies.
35.36. Assess the requirements on the amount of construction materials for the NNPP construction, the origin of the materials, and assess impacts associated to the transportation of the construction materials (emissions, noise).
Requirements on the amounts and origin of the construction materials are described in Chapter B.II.3. Other raw material and energy resources (page 190 in this documentation); impacts associated with the construction and the related transport are assessed in the respective subchapters of Chapter D.I. DESCRIPTION OF EXPECTED PROJECT IMPACTS ON THE POPULATION AND THE ENVIRONMENT AND ASSESSMENT OF THEIR EXTENT AND SIGNIFICANCE (page 372 in this documentation), which also deal with impacts during the construction.
35.37. Request to present a concrete feasibility study for each reactor design type.
The request goes beyond the scope of environmental impact assessment. Information on the technical design of the different reactor design types is provided in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation).
35.38. Include in the documentation the use of cutting-edge cooling tower types with lower structural height and reduced plume.
Cooling towers with lower structural height and reduced plume are so called hybrid towers (HCCT). The limitations of these towers are due chiefly to their procurement and operating costs (significant electricity consumption, which is in conflict with the general requirement to conserve energies). They are therefore mostly designed for use in areas sensitive to location of large industrial installation, and areas with a lack of water. The NPP Temelín site is predestined by the presence of four existing natural airflow towers (Iterson). One or two natural airflow cooling towers per unit are considered depending on the power alternative of the NNPP project. If a single Iterson tower is not acceptable for technical or aesthetic reasons, the logical solution is to install two smaller towers.
35.39. Request to refine technical parameters of the planned units from all potential suppliers.
The detailed technical parameters of the units are provided in Chapter B.I.6. Description of the project technical and technological design (page 60 in this documentation) and its subchapters.
35.40. Provide an objective and demonstrable (opposable) assessment of the zero alternative using the commonly applied methods of proving the benefits of a proposed energy project.
Information necessary for assessment of the justification of the construction of the new power plant is given in Chapter B.I.5.1. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them (page 86 in this documentation). In order to prove the necessity of the project and substantiate the choice of the project, an analysis of the state and trend of the Czech Republic's power distribution system was commissioned along with an assessment of the benefits of the new nuclear power plants for the substitution of power plants near the end of their useful life, fuel availability and the significance of nuclear power plants as a substitute for the domestic coal sources being depleted, and a criteria assessment of four scenarios of development of the energy industry, analysed as part of the Independent Energy Committee (Pačes Committee), according to an internationally recognised set of criteria for sustainable development in the energy industry with the aim to prove both the general societal benefit of all the four scenarios and the benefit of the scenario featuring the new nuclear power plant. The analysis was conducted in compliance with the conclusions of the ascertainment study performed by ENVIROS, s.r.o.
35.41. A consistent assessment of the zero alternative, including savings and renewable sources, and Enviros study if applicable.
The zero alternative is defined in Chapter B.I.5.1. Overview of alternatives considered, specifically subsection B.I.5.2.3. Zero alternative (page 121 in this documentation). The zero alternative is the non-execution of the project, i.e., not building the new nuclear power source at the Temelín site including power output to the Kočín switchyard. The description of the impacts of the zero alternative on the environment and public health is included in Chapter C.II. DESCRIPTION OF THE CURRENT STATE OF THE ENVIRONMENT IN THE AFFECTED AREA (page 223 in this documentation), dealing with a description of the state of the environmental components and public health in the affected area and their development trends, without building the new power plant. The savings and renewables issue is discussed in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation). The section also documents information elaborated by ENVIROS, s.r.o.
Accumulation of impacts:
35.42. Request to include in the environmental impact assessment all the structures and process units directly related to the project without which the “New Nuclear Power Plant” cannot be operated and which have or may have significant environmental impacts (chiefly the expansion of the power transmission system in the broader area of NNP Temelín, expansion of transportation routes in relation to the transfers of oversized components, spent fuel repository, and hot water pipeline for České Budějovice).
Matches Requirement 10. All directly related structures and process units are part of the documentation.
35.43. Make an assessment of cumulative and synergic effects of all pollutants (radionuclides and toxic chemicals) active in the specific location; make the assessment in particular for the event of accident on one of the NPP Temelín nuclear facilities.

Matches Requirement 11. The impacts of the new power plants are assessed in a combined effect with the impacts of the existing power plant, and the existing background. An accident assessment is made in Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.44. Issues concerning the intermediate spent fuel repository inside NPP Temelín in connection to the extension.
The intermediate spent fuel repository (more accurately, the repository) is not part of the project; it will be prepared as a separate investment project when needed. Storage of spent fuel directly in its place of origin is part of the national strategy; it is secured inside NPP Temelín by ongoing construction of adequate storage capacities. A building with a capacity for the first 30 years of spent fuel production from the two existing power plant units, i.e., 1,370 t U, will be commissioned in 2010; additional storage capacities will be executed as needed in a reasonable advance. See Requirement 10 for more detail.
35.45. Assess the environmental impacts due to the back-up power sources and fuel storage.
These impacts are included in the assessment. The environmental impacts of the power source are assessed both in terms of noise and potential air pollution. The fuel storage will be designed in compliance with technical standards; no adverse environmental effects arise if they are observed. The storage employs 2 protective barriers (two-envelope tanks); in an accident, the content will leak into the outer protective tank or the accident sump, from where it will be eliminated by pumping it into a cistern.
35.46. Assess the mutual effects of the new power plant with other nuclear facilities in the area (old units and intermediate fuel repository).
Matches Requirement 11. The impacts of the new power plant are assessed in a combined effect with the impacts of the existing power plant, and (more generally) the existing background.
Safety and public health:
35.47. Request to monitor the health of the population in an increased extent, especially in municipalities within the 5-kilometre zone, including annual presentation of results of such checks in the municipalities for the inhabitants to view.
The health of the population has been monitored since 1999 as part of the scheme of monitoring the environmental impacts of the power plant. The annual results are publicly available in the power plant information centre.
35.48. Request to extend the existing emergency planning zone due to increased hazard to the population.
No need to extend the emergency planning zone follows from the required safety parameters of the project. The assignment for the building contractor includes requirements to limit emergency releases in a way that potential releases do not pose an increased threat to the population within the existing emergency planning zone and a significant threat to other populations outside that zone. See Requirement 15 for more detail.
35.49. Elaborate an assessment of the impacts of the project on the health of the population, which shall be based, among other things, on the current results of environmental impact monitoring (in an extent equal to that of the existing monitoring performed by the applicant).
The assessment is part of the documentation and is made in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation).
35.50. Reminder of an existing Government Regulation dealing with electromagnetic radiation.
Government Regulation no. 1/2008 Coll. on health protection from non-ionising radiation deals with electromagnetic radiation.
35.51. Elaborate a noise analysis, including detailed specification of noise sources.
A noise analysis, including specification of noise sources, is part of the documentation.
35.52. Request to describe the project in the following spheres: safety concept and basic safety criteria, geological, hydrogeological and seismological conditions in the area, protective envelope (containment) and other structures relevant to safety, principle of defence in depth, principle and concept of safety systems, description of safety-relevant components, accident requirements, concept of handling spent nuclear fuel, radioactive waste handling system, radioactive discharges, nuclear safety provisions.
The above requests are part of Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation). See Requirement 13 for more detail.
35.53. Focus on seismic monitoring of the area in terms of both current situation and forecasting.
Information on seismic activity in the area, including forecasts, are part of Chapter C.2.6. Rock environment and natural resources (page 326 in this documentation).
35.54. Request to present a concept for the safe decommissioning of the “New Nuclear Power Plant” and assessment of mainly the radiation impacts and other impacts of the chosen method in the sense of Section 5, paragraph 3 of Act no. 100/2001 Coll.
A decommissioning concept is stated in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.7. Information on decommissioning (page 179 in this documentation).
35.55. Issues of accident emergence and the related functioning of barriers preventing releases of radioactive substances into the environment.
Information on the technical design of the barriers is provided in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation) accidents are dealt with in Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.56. Document the capacity of the “New Nuclear Power Plant” to withstand external threats, especially falling aircraft, and the related environmental risks.
Project information on nuclear safety is given in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.1.4. Information on safety assurance (page 126 in this documentation).

35.57. Request to assess impacts of not only normal operation, but also serious accidents of the nuclear facility; based on that assessment, proceed to design the extent of the emergency preparedness zone so that it is sufficient and demonstrable, with respect to both the new power plant and the spent fuel repository; follows the same steps for the external emergency plan.
Accident assessment is part of Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation). See Requirement 15 for more detail.
35.58. Issues of proximity of Bechyně military airfield and its use of NPP Temelín no-fly zone for practising; analogously, consider the proposed civilian airfield at Planá near České Budějovice.
Issues of air traffic and no-fly zones are discussed in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.4. Construction design data (page 167 in this documentation).
35.59. Request to make a detailed and transparent description of the inherent (internally bound) safety properties and passive safety equipment, including a description of redundant (back-up) safety systems.
Project information on nuclear safety is given in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.1.4. Information on safety assurance (page 126 in this documentation). The project involves 3rd or 3+ generation units, which are currently the best available safety level units. Proofs of safety containing the requested detailed descriptions are only feasible as part of the licensing procedure, which the selected supplier has to undergo and the affirmative result of which is the prerequisite for the project execution. The probability of failure of safety barriers and the radiation consequences of a potential ensuing facility accident are relevant to the environmental impact assessment. The documentation includes such information.
35.60. Request to describe residual risk of uncontrolled development of a chain nuclear reaction and release of ionising radiation and radioactive substances into the surrounding area.
Project information on nuclear safety is given in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.1.4. Information on safety assurance (page 126 in this documentation). Accident assessment is part of Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 193 in this documentation).
35.61. Request to consider the costs and mainly the risk associated with the follow-up nuclear power plant project, as well as the impacts of consumer prices, which are derived from the conditions on the European market.
This goes beyond the scope of the documentation: economic analysis is not the subject matter of an environmental impact assessment. These issues are discussed at a more general level in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.62. Concerns about safety of both existing nuclear power plant units and the new ones.
Project information on nuclear safety is given in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.1.4. Information on safety assurance (page 126 in this documentation). Accident assessment is part of Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.63. Issue of suitability of the geological bedrock of the area for building a nuclear power plant.
The issues of geological conditions in the affected area are discussed in Chapter C.2.6. Rock environment and natural resources (page 326 in this documentation) and in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.4. Construction design data (page 167 in this documentation).
35.64. Disapproval of building nuclear power plants due to their high risk rate and conflict with principles of sustainable economy and energy generation.
Safety issues are a matter of state supervision and within the jurisdiction of the State Office for Nuclear Safety. Accident assessment is part of Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation). Analogously, the national energy strategy is a matter of state policy; it is discussed in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.65. Disapproval of building nuclear power plants due to the great proximity of facilities and potential impacts of accidents.
Accident assessment is part of Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.66. Disapproval of building nuclear power plants due to doubling the radioactive inventory at Temelín, thus increasing the amounts of released pollutants and due to the entire facility and increased frequency of accidents.
Radiation impacts are assessed in Chapter D.I.3. Impacts on noise conditions and other physical and biological characteristics (page 404 in this documentation), specifically its subchapter D.I.3.3. Impacts of ionising radiation. The assessment is made for the combined effect of the existing and new power plants. Accident assessment is part of Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.67. Request to provide radioactive inventory data.
Over the 60 years of operation of the 4 units, special guarded repositories inside NPP Temelín collect approximately 5.6 to 7.8 thousand tonnes of spent nuclear fuel. See Requirement 12 for more information.
35.68. Request to perform a survey of potential exposure of populations in neighbouring countries to radiation based on the use of meteorological data representative in time and space for the expected permitted airborne emissions.
Radiation impacts are dealt with in Chapter D.I.3. Impacts on noise conditions and other physical and biological characteristics (page 404 in this documentation), specifically its subchapter D.I.3.3. Impacts of ionising radiation.
35.69. Issues of resistance of the nuclear power plant containments, especially in connection with the dense air traffic.

Information on the requirements on the power plant buildings and air traffic is given in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.4. Construction design data (page 167 in this documentation).
35.70. Expand the chapter on potential effects of radiation accidents, design safety barriers for the selected reactor types so that immediate action (search for shielded spaces, iodine prophylaxis, and evacuation) is not required even in the event of an accident.
These issues are handled in Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.71. Request to present an analysis that will consider not only the impacts of an accident on the specified location and its immediate vicinity, but will make a quantitative picture of the potential radiation exposure of the population and the likelihood of its occurrence in the borderlands of neighbouring countries.
These issues are handled in Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.72. Add assumed routes for alarming populations in neighbouring countries during events with releases of radioactive substances from the new units.
Neighbouring countries are informed about events at the power plant via standard channels based on intergovernmental agreements on timely notification on events and information exchange on peaceful utilisation of nuclear energy. Wording of the intergovernmental agreements are available at http://www.sujb.cz.
35.73. When selecting the source type, consider safety criteria; describe the safety and technical design of each reactor type in order to define them.
Project information on nuclear safety is given in Chapter B.I.6.Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.1.4. Information on safety assurance (page 126 in this documentation). The description of the technological and structural design in Chapter B.I.6 also focuses on safety aspects in the extent proportionate to the requirements of the ascertainment procedure and goals of EIA documentation. The safety criteria are based on legislation in force and other relevant documents, and are specified in the assignment documentation published, and their observance will be a criterion for assessing bids within the selective procedure. An affirmative assessment of the safety level achieved as part of the licensing procedure will be a precondition for the project execution.
35.74. Add probability rates of accident due to active zone meltdown or large releases of radioactive substances for each reactor type, including a description of all environmental risks associated with potential accidents (this includes radionuclides released into the air) that make it possible to assess transboundary impacts of accidents even if the occurrence probability is low.
Safety issues are part of Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.75. Request for a systemic description of the main aspects of sizing and safety levels of the proposed reactor alternatives so that these data are comparable and give a more accurate picture of the reactor alternatives.
Project information on nuclear safety is given in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapters B.I.6.4. Construction design data (page 167 in this documentation) and B.I.6.1.4 Information on safety assurance (page 126 in this documentation).
35.76. Request to assess transboundary consequences of a serious accident with a massive radioactive release.
These issues are part of Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.77. Detailed description of what safety standards new nuclear power plants have to comply with, with respect to IAEA regulations and European Utility Requirements and other relevant standards.
Project information on nuclear safety is given in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapters B.I.6.4. Construction design data (page 167 in this documentation) and B.I.6.1.4 Information on safety assurance (page 126 in this documentation). The required standards are listed there as well. The EU Directives implemented in the Czech legislation as well as the European Utility Requirements for LWR Nuclear Power Plants as well as important recommendations by the ICRP, IAEA and WENRA are very extensive documents. A detailed description of requirements to meet these safety standards would necessarily be an analogously extensive paper, comprising thousands of pages. That is why Chapter B.I.6 only includes a brief list of the basic safety requirements. For those interested in more detailed information, the reference documents are publicly accessible on the websites of the respective institutions.
35.78. Absence of information relevant to the safety of each reactor type.
Project information on nuclear safety is given in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapters B.I.6.4. Construction design data (page 167 in this documentation) and B.I.6.1.4 Information on safety assurance (page 126 in this documentation). The project only considers a PWR type reactor of the 3rd or 3+ generation, at two capacity levels. Chapter B.I.6 specifies safety requirements for this defined type; they are based on requirements of Czech legislation, the EUR and recommendations by the ICRP, IAEA and WENRA.
35.79. Observation that the existing power plant is not of an adequate safety standard and that it has not been refurbished in respect of its safety aspects.

This goes beyond the scope of the documentation; the safety standard of the existing power plant is not the subject matter of the assessment. Nuclear power facilities in the CR are continuously assessed in terms of nuclear safety provision quality both by SONS and in the form of international missions (IAEA, WANO, EU appraisal). All the proofs presented by the SONS, as well as conclusions of the international safety missions, demonstrate clearly that the nuclear safety of Temelín Power Plant is at a high quality level and complies with both the requirements currently in force in the Czech Republic and generally accepted international standards. This condition is regularly examined and evaluated in light of the latest scientific and technical findings. Necessary activities are scheduled and conducted so that this condition can be maintained or improved in future.
35.80. Concerns about accumulation of nuclear facilities in connection with a potential terrorist attack.
Project information on nuclear safety is given in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapters B.I.6.4. Construction design data (page 167 in this documentation) and B.I.6.1.4 Information on safety assurance (page 126 in this documentation).
35.81. When assessing impacts on human health, consider studies abroad which point out possible adverse effects of low doses of ionising radiation on human health and studies assessing the health of nuclear power plant workers using the latest methods, so called biomarkers.
Assessment of impacts on human health is handled in Chapter D.I.1. Impacts on the population, including social and economic impacts (page 372 in this documentation), specifically its subchapter D.I.1.1. Health impacts and hazards. The assessment is made in compliance with legislation in force, based on procedures and recommendations of the ICRP (International Commission on Radiological Protection), which is a respected international authority and reflects results of scientific research into radiation protection. Other methods, which have not passed the opponency proceedings of the organisation or which are not based on a valid legislative foundation, cannot be employed in the assessment. (Note: Scientific literature has recently also quoted numerous evidence of a positive effect of low doses of ionising radiation. They are not taken into consideration, though, as they have not been generally accepted at the moment.)
35.82. Request to assess the impact of beyond design basis failures or accidents on the environment and the population.
These issues are part of Chapter D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).
35.83. Request for a more comprehensive discussion of the seismicity in the area, consideration of currently commenced surveys of tectonic fault potential.
The seismicity of the site is discussed in Chapter C.II.6. Rock environment and natural resources (page 326 in this documentation).
35.84. In the general ideas on safety, the documentation should discuss in detail issues of mutual effects of the other nuclear facilities on the site, vulnerability of the nuclear power plant to external impacts, seismicity of the site, possible impacts due to climate change, the concept of storing spent nuclear cartridges, including the radionuclide inventory for the fuel alternatives.
The above requests are handled in the relevant chapters in this documentation.
Spent fuel and waste:
35.85. Add the quantity of waste generated during the operation of the new nuclear power plant (low, medium and high activity waste).
The amounts of radioactive waste generated are specified in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter III.4.3. Radioactive waste (page 214 in this documentation).
35.86. Recommendation to bring the terminology concerning waste pursuant to Act no. 185/2001 Coll. in harmony with the terminology used in that Act.
The terminology used is in harmony with Act no. 185/2001 Coll. on waste.
35.87. Request to assess the method of handling waste, especially highly radioactive, including spent fuel, and how that waste will be treated not only theoretically but also practically.
The method of handling radioactive waste and spent fuel is described in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter III.4.3. Radioactive waste. Among other things, the concept of radioactive waste handling is based on the provisions of the Atomic Act, pursuant to which the state organisation RAWRA is responsible for depositing radioactive waste. The related projects in this area are not the subject matter of the project being assessed, meaning they can be quoted only, but not assessed.
35.88. Request for information on the amount of spent fuel assumed throughout the operating period, and on the capacity of the planned intermediate repository inside the NPP Temelín area.
The quantity of spent nuclear fuel is determined in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter III.4.3. Radioactive waste. The repository capacity will match that quantity. See Requirement 12 for more detail.
35.89. Request to make a detailed description of the amount of generated operating waste in the low, medium and high activity waste categories for each alternative assumed.
The amounts of radioactive waste generated are specified in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter III.4.3. Radioactive waste.
35.90. Request to describe on which sites, for how long and in what quantities the various radioactive waste components will be deposited.
The method of handling radioactive waste and spent fuel is described in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter III.4.3. Radioactive waste.
35.91. Request to document a functional, permanent, safe and practically tested method of disposal of highly radioactive waste.

The State guarantees the safe deposition of radioactive waste (pursuant to Act no. 18/1997 Coll., the Atomic Act). The Radioactive Waste Repository Administration (RAWRA), an organisational component of the State, is established for this purpose. The activities of the RAWRA are defined in section 26 (3) of Act no. 18/1997 Coll., the Atomic Act, and include (among other things) the preparation, construction, commissioning, operation and decommissioning of nuclear waste repositories and monitoring of their impact on the surroundings. The deep repository is therefore being prepared by the state organisation RAWRA, including the finding of a suitable site.
35.92. Issues of spent nuclear fuel repository in connection to increasing the nuclear power plant capacity.
A spent fuel repository is not part of the project; it will be prepared as a separate investment project when needed. Storage of spent fuel directly in its place of origin is part of the national strategy; it is secured inside NPP Temelín by ongoing construction of adequate storage capacities. A building with a capacity for the first 30 years of spent fuel production from the two existing power plant units, i.e., 1,370 t U, will be commissioned in 2010; additional storage capacities will be executed as needed in a reasonable advance. See Requirement 10 for more detail.
35.93. Finalise a detailed quantitative chart of radioactive waste generated during the operation, classified into low radioactivity, medium radioactivity and high radioactivity waste, where they will be stored and in what quantities, and what storage capacities are available.
The method of handling radioactive waste and spent fuel is described in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter III.4.3. Radioactive waste.
35.94. Request to present a concept for the safe decommissioning of the power plant and disposal of spent nuclear fuel, including a way of arranging the funding; refine the vague plans for the deep repository after 2065, and the associated concern about permanent deposition of SNF inside NNPP Temelín.
The method of handling radioactive waste and spent fuel is described in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter III.4.3. Radioactive waste. The State is responsible for radioactive waste in the Czech Republic; it has established the Radioactive Waste Repository Authority (RAWRA) for this purpose. More detailed information can be found on the RAWRA website (www.surao.cz, www.rawra.cz).
35.95. Expression of concerns that a radioactive waste repository is currently not known.
The State is responsible for radioactive waste in the Czech Republic; it has established the Radioactive Waste Repository Authority (RAWRA) for this purpose. The organisation is also preparing a radioactive waste repository. More detailed information can be found on the RAWRA website (www.surao.cz, www.rawra.cz).
35.96. Concerns about potential misuse of nuclear fuel.
Information on assuring the physical guarding of the nuclear fuel is given in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.1.4. Information on safety assurance (page 126 in this documentation).
35.97. Issues and potential risks of transporting spent fuel cells from the nuclear power plant to the permanent repository.
Transportation of nuclear materials and radioactive substances will be handled in compliance with the 2001 Concept of handling radioactive waste and spent nuclear fuel in the Czech Republic, pursuant to SONS executive legal regulations, especially SONS Decree no. 144/1997 Coll. on physical protection of nuclear materials and nuclear facilities and their classification into categories, and SONS Decree no. 317/2002 Coll. on type approval of packaging assemblies for transport, storage and disposal of nuclear materials and radioactive substances, on type approval of ionising radiation sources and on transport of nuclear materials and specified radioactive substances (on type approval and transport).
35.98. Specify details of available storage capacities for radioactive waste on the different sites in the CR, and provide information on the state of planning a radioactive waste repository.
The State is responsible for radioactive waste in the Czech Republic; it has established the Radioactive Waste Repository Authority (RAWRA) for this purpose. More detailed information can be found on the RAWRA website (www.surao.cz, www.rawra.cz).
Transportation:
35.99. Focus on environmental impacts in connection to transportation near the project site and increased numbers of workers during construction and operation.
Impacts during the project preparation and execution are assessed in the relevant chapters of this documentation.
35.100. Request to make use of railway during TNPP construction.
The power plant site has a railway siding, so the railway can be used effectively for the construction.
35.101. Request to clearly define transport corridors in connection to transporting materials for TNPP construction.
Transportation requirements during the project construction are specified in Chapter B.I.6. Description of the project technical and technological design (page 121 in this documentation), specifically its subchapter B.I.6.6. Construction data (page 176 in this document), and B.II.4. Demands on transport and other infrastructure (page 192 of this document).
35.102. Concerning the increased car traffic, elaborate a paper that will propose measures to reduce the environmental impacts of that traffic (especially noise and dust) in municipalities through which it will flow (bypasses, noise reducing measures, etc.).
Measures to reduce traffic impacts are specified in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).
35.103. Do no route traffic on routes via Novosedly, Dubenec, Zbudov and Dívčice, which are already suffering from traffic in connection to the reclamation of a settling basin in a former uranium ore processing plant.

Measures to reduce traffic impacts are specified in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation). Routes via Dubenec and Zbudov are out of all consideration for construction traffic. Novosedly and Dívčice lie on road II/122 (Netolice - Dříteň segment). This road is expected to see an increase in traffic due to the NNPP construction by some 23 lorries per 24 hours, which is approximately 3.7% of the prospective number of lorries in 2015. Impacts of traffic associated with the construction (noise, air) are immaterial; the change due to the construction traffic will be outside practical measurability (96.3% of the traffic on the roads will not be associated with the project development). Transportation corridors during the project operation are described in Chapter B.II.4. No significant traffic is assumed to go via Dubenec, Zbudov, Novosedly and Dívčice during the operation.
35.104. Resolve transport infrastructure issues in Paseky before construction starts, especially in relation to road no. II/159, which the TNPP emergency plan defines as an escape route, whereas it carries significant amounts of traffic at present.
Measures to reduce traffic impacts are specified in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).
35.105. Environmental impacts associated with connection to the public roads.
Impacts on transport infrastructure are assessed in Chapter D.I.10. Impacts on transport and other infrastructures (page 510 in this documentation).
35.106. Request to assess impacts of traffic during both the new power plant construction and operation, especially if not compliant with the transport priorities set by the South-Bohemian Regional Council in August 2008 in its Position Statement on the 2008 Draft Territorial Development Policy of the CR.
Impacts on transport infrastructure are assessed in Chapter D.I.10. Impacts on transport and other infrastructures (page 510 in this documentation).
35.107. Issues of capacity and inadequate winter maintenance of roads intended for potential evacuation.
Impacts on transport infrastructure are assessed in Chapter D.I.10. Impacts on transport and other infrastructures (page 510 in this documentation); the measures are specified in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).
35.108. Request to assess transboundary impacts in the following aspects as well: traffic during construction (equipment deliveries) and traffic and transport during operation (fuel cell recycling).
Impacts on transport infrastructure are assessed in Chapter D.I.10. Impacts on transport and other infrastructures (page 510 in this documentation). Major transboundary impacts are ruled out. Reprocessing of spent/used nuclear fuel is currently only a prospectively pursued path of efficient utilisation of nuclear materials, which the technical project design does not rule out for the future. If any relevant agreements are made with a reprocessing facility abroad in future, the transportation will follow requirements set by the International Convention on Transport of Dangerous Goods (radioactive materials are included in Class 7) and safety requirements set by the Convention to reduce adverse environmental impacts during both normal transportation and a traffic accident. Given the quantity of spent nuclear fuel generated and radioactive waste produced during reprocessing, the traffic is negligible compared to the amounts of other commodities transported.
Groundwater and surface water:
35.109. Assess the potential impacts of climate change on the assurance of permanent water supplies (cooling) and suitability of the watercourse.
Demands on water supplies are described in Chapter B.II.2. Water (page 188 in this documentation). Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation). The potential climate change is reflected in the data.
35.110. Request to remedy inconsistence concerning wastewater discharges.
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation).
35.111. Requests to assess the impact of the construction on the quality and quantity of drinking water supplying the Zdoba cistern.
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation). The construction will result in increased drinking water consumption. Given the existing capacity of the cisterns and the size of the delivery pipelines (2xDN400), it can be concluded that the capacity will suffice the increased consumption. As concerns quality, the effect will be positive because the exchange will be faster and the accumulation period reduced, thus resulting in improved quality of the water consumed.
35.112. Request to assess the impact of wastewater discharged (especially chemical composition) on humans, including assurance of periodic inspections of the discharge lines.
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation). Impacts on the population are assessed in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation).
35.113. Request to add a balance of all waters (raw water, drinking water, process water, etc.).
The water balances are given in Chapters B.II.2. Water (page 188 in this documentation), and B.III.2. Wastewater (page 200 in this documentation).
35.114. Specify wastewater treatment in conformity with the valid legislation.
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation).

35.115. Observe requirements made by Government Regulation no. 61/2003 Coll. on indicators and values for admissible levels of surface and waste water pollution, on formalities concerning permission to release sewage into surface waters and into the sewer system, and on sensitive areas, as amended by Regulation no. 229/2007 Coll., and rules set by Decree no. 450/2005 Coll. on the requisites of handling harmful substances and on the requisites of an emergency plan, the manner and scope of reporting accidents, remedying thereof and elimination of their adverse consequences.
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation). The assessment includes a comparison with the applicable legislative requirements.
35.116. Unequivocally assess the impact on flow rates in the Vltava, possible oscillation of the water level in Hněvkovice reservoir due to water consumption for the NNPP cooling system in addition to existing consumption for TNPP under various hydrogeological conditions.
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation).
35.117. Assess the impacts of discharging used heated water and tritium-containing water back into the Vltava in a synergy with the existing discharges from TNPP.
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation). The impacts are assessed for a combined effect.
35.118. Assess the impact on groundwater with respect to the already existing disruption of the shallow circulation due to TNPP construction.
Matches Requirement 28. Impacts on groundwater are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation).
35.119. As part of the hydraulic study to form an annexe to the EIA documentation, elaborate a hydraulic design of Hněvkovice reservoir to assure the required quantity of surface water consumption.
The annexe includes a hydraulic design. Demands for water consumption are given in Chapters B.II.2. Water (page 188 in this documentation).
35.120. Recommendation to elaborate the assessment with respect to compliance with general requirements on pollution standards (Annexe 3 to Government Regulation no. 61/2003 Coll.).
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation). The assessment includes a comparison with the applicable legislative requirements.
35.121. Recommendation to elaborate an assessment of impacts of TNPP on eutrophication in Orlík reservoir, including the possible reduction in Pc amounts in wastewater discharged into the surface waters.
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation).
35.122. Request to consider the plan to make the Vltava navigable.
Impacts on water are assessed in Chapter D.I.4. Impacts on surface water and groundwater (page 449 in this documentation); the potential navigability of the Vltava is considered.
35.123. Issues of emissions into surface waters, request to report all the relevant radionuclides, including a clarification of the values monitored (empirical versus permitted values) in connection to the determination of the reactor type, convert the emissions depending on the concept and operating mode of the reactor and its auxiliary and external devices, choose the reactor with consideration of these aspects.
The radioactive discharges are specified in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter B.III.4.2. Liquid radioactive discharges.
35.124. Issues of burdening of surface waters with radionuclides, especially tritium.
Burdening of surface waters with radionuclides is described in Chapter C.2.3. Noise and other physical and biological characteristics (page 257 in this documentation), specifically its subchapter C.2.3.3. Ionising radiation. Impacts on burdening of surface waters with radionuclides are assessed in Chapter D.I.3.Impacts on noise conditions and other physical and biological characteristics (page 404 in this documentation), specifically its subchapter D.I.3.3. Impacts of ionising radiation.
35.125. Issues of quantification of the transboundary impacts of radioactive substances discharged into the Vltava, as these substances may get into the Elbe and then to Germany.
Impacts on burdening of surface waters with radionuclides are assessed in Chapter D.I.3. Impacts on noise conditions and other physical and biological characteristics (page 404 in this documentation), specifically its subchapter D.I.3.3. Impacts of ionising radiation.
35.126. Request to clarify the emissions quoted, whether they are permitted values or empirical operating values.
The radioactive discharges are specified in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter B.III.4.2. Liquid radioactive discharges. The quoted emissions are linked to the PWR reactor type considered and its capacity alternatives considered. The quoted values are conservative expert estimates based on available information about PWR units in operation and planning. The permitted values of radionuclide pollution, so called authorised limits for discharges into the air and surface waters, will only be defined by the respective administrative procedure pursuant to the Atomic Act; the level must not exceed the limits set by Decree no. 307/2002 Coll. on radiation protection.
35.127. Disagreement with the values of assumed radionuclide emissions specified in the notification; the list is incomplete, the emissions may be higher.
The radioactive discharges are specified in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter B.III.4.2. Liquid radioactive discharges.
Fauna, flora and ecosystems:

35.128. Request to conduct a biological survey in the area in question, including in light of the increased power output to Kočín switchyard and increased capacity of water delivery line from Hněvkovice reservoir.
A biological survey on these sites is part of the documentation. Information on the biological survey is given in Chapter C.II.7. Fauna, flora and ecosystems (page 337 in this documentation).
35.129. Propose compensatory measures in the form of adequate substitute planting in connection with the assumed felling of trees and shrubs.
The measures are specified in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).
35.130. Based on biological surveys conducted, assess the impact on the flora, fauna and ecosystems, with respect to any presence of specially protected species and their biotopes; based on that, propose specific measures to prevent, eliminate, reduce or compensate for adverse impacts on the flora, fauna and ecosystems.
An assessment of these impacts is made in Chapter D.I.7. Impacts on fauna, flora and ecosystems (page 468 in this documentation). The measures are specified in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).
35.131. Request to assess impacts on the landscape character.
Impacts on the landscape character are assessed in Chapter D.I.8. Impacts on landscape (page 500 in this documentation).
35.132. Assess impacts on protected and specially protected animal species present in the succession wetland on the site of the proposed NNPP development, and propose measures to protect them.
An assessment of these impacts is made in Chapter D.I.7. Impacts on fauna, flora and ecosystems (page 468 in this documentation). The measures are specified in Chapter D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS (page 536 in this documentation).
35.133. In addition to the occupation of land intended to fulfil forest functions, the documentation also has to assess sites on which the structure (power output) will be located and within 50 m of the forest edge.
The assessment is made in Chapter D.I.7. Impacts on fauna, flora and ecosystems (page 468 in this documentation).
35.134. Issues of the potential genotoxic impact of tritium of some aquatic organisms.
These issues are discussed in Chapter D.I.7. Impacts on fauna, flora and ecosystems (page 468 in this documentation).
Climate and air:
35.135. Make a detailed assessment of the impact of the microclimate change due to the evaporation from the cooling towers on nearby ecosystems.
Impacts on climate are assessed in Chapter D.I.2. Impacts on air and climate (page 396 in this documentation).
35.136. Issues of emissions of radioactive substances from nuclear power plants compared to emissions of radioactive substances from fossil-fuel power plants.
Issues of emissions of radioactive substances from fossil fuels goes beyond the scope of this documentation; it is discussed generally in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.137. Assess the impact of the waste heat emitted from the cooling towers in combination with the heat emitted by TNPP.
Impacts on climate are assessed in Chapter D.I.2. Impacts on air and climate (page 396 in this documentation), for a combined effect of the existing and new units.
35.138. Request for a more detailed description of emissions into the air taken from the inspection zones of the NPP Temelín units (add I-131 and aerosol emissions) in connection to the determination of the reactor type, convert the emissions depending on the concept and operating mode of the reactor and its auxiliary and external devices, choose the reactor with consideration of these aspects.
The radioactive discharges are specified in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter B.III.4.1. Gaseous radioactive discharges.
35.139. Issues of water vapour and waste heat emissions as sources impacting on South Bohemia's climate.
Impacts on climate are assessed in Chapter D.I.2. Impacts on air and climate (page 396 in this documentation).
35.140. Issues of dispersion of radionuclides in South Bohemia with respect to the low wind speeds and inversion weather.
Information on dispersion of radionuclides is given in Chapter B.I.3. Impacts on noise conditions and other physical and biological characteristics (page 404 in this documentation), specifically its subchapter D.I.3.3. Impacts of ionising radiation.
35.141. Request to assess transboundary impacts for emissions of chemical pollutants from the cooling towers (emission dispersion across national boundaries).
Impacts on air are assessed in Chapter D.I.2. Impacts on air and climate (page 396 in this documentation). The case concerns emissions of ammonia (NH_3), used in the cooling circuit. Major transboundary impacts are ruled out.
35.142. Absence of data on indirect greenhouse gas emissions of the planned nuclear power plant described based on an analysis of its entire lifecycle (especially preceding process chains and subsequent process chains).
Issues of indirect greenhouse gas emissions go beyond the scope of this documentation; it is discussed generally in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.143. Issues of discharges of tritium emissions; specify under what special conditions these emissions are produced in TNPP.

Information on tritium emissions is given in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter B.III.4.1. Gaseous radioactive discharges, and B.III.4.2. Liquid radioactive discharges.
35.144. Request to clarify the emissions quoted, whether they are permitted values or empirical operating values.
The radioactive discharges are specified in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter B.III.4.1. Gaseous radioactive discharges. The quoted emissions are linked to the PWR reactor type considered and its capacity alternatives considered. The quoted values are conservative expert estimates based on available information about PWR units in operation and planning. The permitted values of radionuclide pollution, so called authorised limits for discharges into the air and surface waters, will only be defined by the respective administrative procedure pursuant to the Atomic Act; the level must not exceed the limits set by Decree no. 307/2002 Coll. on radiation protection.
35.145. Disagreement with the values of assumed radionuclide emissions specified in the notification; the list is incomplete, the emissions may be higher.
Information on radionuclide emissions is given in Chapter B.III.4. Others (page 208 in this documentation), specifically its subchapter B.III.4.1. Gaseous radioactive discharges.
35.146. Conduct an analysis of indirect greenhouse gas emissions.
Issues of indirect greenhouse gas emissions go beyond the scope of this documentation; it is discussed generally in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
Social aspects:
35.147. Issues of employment near the NNPP and professional capacities for the construction and operation of nuclear power plants.
Employment issues are handled in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation). Professional capacity issues go beyond the scope of this documentation.
35.148. Requests for compensatory measures in the form of investment in public facilities (infrastructures, WWTP, etc.).
These issues go beyond the scope of this documentation. They are handled at the political level.
35.149. Impacts on real estate prices.
These issues are discussed in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation).
35.150. Impact on tourism near the project as well as the Bayrischer Wald / Šumava National Parks, and potential compensations if the region loses its image.
These issues are discussed in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation). Major transboundary impacts are ruled out.
35.151. Issues of development of residential development in settlements near TNPP and impacts on downfall of enterprises.
These issues are discussed in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation).
35.152. Request to present hard data to prove what social and economic enhancement has taken place in the area due to TNPP and how the quality of intellectual life of the Temelín population has been positively affected, and assess the benefits of the new units from the same angle.
Issues of impacts on the population are discussed in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation).
Others:
35.153. General disapproval of nuclear power.
This goes beyond the scope of the documentation. An approval or disapproval with an entire energy industry is not the subject matter of an environmental impact assessment.
35.154. Connection of the project with increased uranium extraction.
Issues of uranium mining are discussed in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.155. Possible reduction in available uranium reserves (possible impact of price increases on the economics of the planned facility).
Issues of uranium reserves are discussed in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation).
35.156. Issues of affected municipalities.
The list of affected municipalities is connected to the project location and is made in Chapter B.I.8. List of affected self-governing territorial units (page 183 in this documentation).
35.157. Issues of delays in construction and their impacts on the economy.
Economic aspects are not the subject matter of an environmental impact assessment.
35.158. Complete the list of associated decisions and administrative authorities to issue such decisions (Chapter B.I.9.).
The list of associated decisions is made in Chapter B.I.9. List of associated decisions as per Section 10, paragraph 4, and the administrative authorities to issue such decisions (page 183 in this documentation).
35.159. Issues of sufficient information and documentation for affected state administration authorities in light of their specialisation.
An environmental impact assessment provides primarily information necessary for determining expected impacts on the environment and a proposal of measures to reduce adverse impacts. This information is one of the foundations for ensuing administrative procedures run by respective state administration authorities.
35.160. Issues of indemnity assurance, insured indemnity amounts, definition of persons entitled to demand indemnification.

Indemnity assurance issues are handled by legislation in force and are not the subject matter of an environmental impact assessment. At present, the liability of the operator of a nuclear facility is assessed pursuant to Sections 32-38 of the Atomic Act (Act no. 18/1997 Coll., as amended) and the Vienna Convention on Civil Liability for Nuclear Damage and the Joint Protocol on Application of the Vienna Convention and the Paris Convention (the "Convention"), declared under no. 133/1994 Coll. General provisions of the Civil Code on liability or quantities and scopes of indemnification shall only be applied unless the Convention or the Atomic Act specify otherwise. At present, the issues of liability for nuclear damage is being handled by the European Union in respect of harmonising the standards across the Member States.
35.161. Requests to withdraw from the project to build new units.
This goes beyond the scope of the documentation. Decision on executing a project is not the subject matter of an environmental impact assessment.
35.162. Request to explicitly describe potential transboundary impacts.
Potential transboundary impacts are described and assessed; significant transboundary impacts are ruled out.
35.163. Issues of effects of noise during the frequent shutdowns of the existing power plant and Kočín switchyard, and impacts of the population's psychic condition.
This concerns the existing power plant. Noise impacts are handled in Chapters C.2.3. Noise and other physical and biological characteristics (page 257 in this documentation), and D.I.3. Impacts on noise conditions and other physical and biological characteristics (page 404 in this documentation).
35.164. Issues of landscape character and aesthetic aspects.
Impacts on the landscape character are assessed in Chapter D.I.8. Impacts on landscape (page 500 in this documentation).
35.165. Requests of a process nature (for public hearings, submission of a reworked notification, etc.).
Process requirements are laid out by Act no. 100/2001 Coll. on Environmental Impact Assessment, as amended.

PART A
APPLICANT INFORMATION

A.1. Business name

ČEZ, a. s.

A.2. Company identification number

45274649

A.3. Registered office (Residence)

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140 53 Prague 4
Czech Republic

A.4. Name, surname, address and telephone no. of applicant's authorised representative

Ing. Petr Závodský
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PART B
PROJECT INFORMATION

B.I. BASIC INFORMATION

B.I.1. Project title and its categorisation under Annexe 1

B.I.1.1. Project title

New nuclear power plant in Temelín, including power output to Kočín switchyard

B.I.1.2. Project classification

The project classification pursuant to Act no. 100/2001 Coll. on environmental impact assessment, as amended by Acts no. 93/2004 Coll., 163/2006 Coll., 186/2006 Coll., and 216/2007 Coll. is as follows:

category:	I
item:	3.2
title:	Facilities with nuclear reactors (including their dismantling or final shutdown) except research facilities the maximum power output which does not exceed 1 kW of continuous thermal load.
column:	A

According to Section 4 of the Act, the project falls under paragraph 1, item a) and is always subject to assessment pursuant to the Act.

According to Section 21, item c) of the Act, the Ministry of the Environment is the applicable authority.

The classification of the project is related to the project as a whole, including all the related structures and process equipment[1].

B.I.2. Project capacity (scope)

The project capacity is as follows:

total net installed output: up to 3400 MW_e

B.I.3. Project location (region, municipality, cadastral area)

The project is located in the Czech Republic in the territory of the following territorial units:

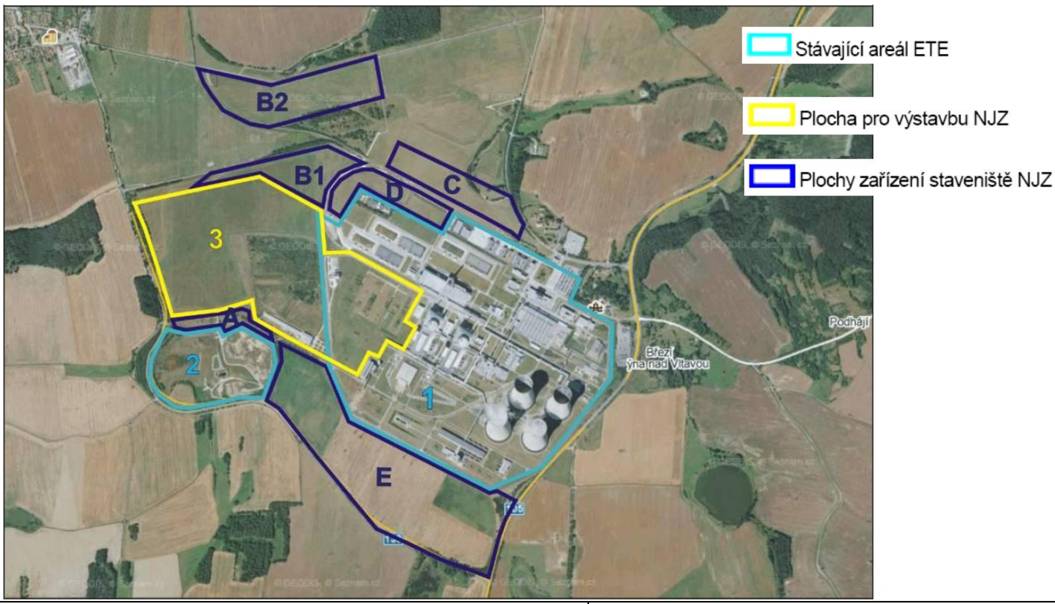
[1] Component structures and/or process units related to the project may be classified differently under Annexe 1 to the Act. This fact has no effect on the overall project classification.

Region	*District*	*Site*	*Cadastral area*
South-Bohemian	České Budějovice	Temelín	Březí u Týna nad Vltavou; 613941 Křtěnov; 613975 Temelín; 765805 Temelínec; 765813 Litoradlice; 685828 Kočín; 613967
		Dříteň	Chvalešovice; 654981

A list of affected land plots for the NNPP construction is made in Chapter B.II.1. Soil (page 185 in this documentation).

The project location is evident from the below figures:

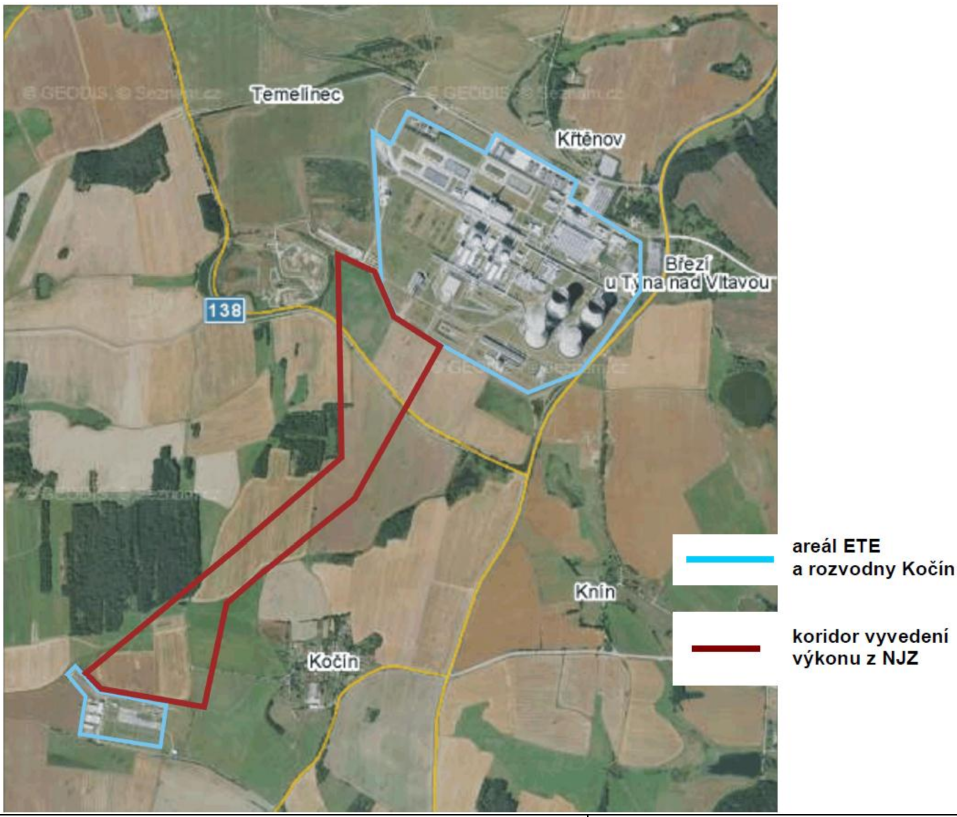
Figure B.I.1: Position of area for NNPP construction and site facilities, relation to existing NPP Temelín



Stávající areál ETE	*Existing NPP complex*
Plocha pro výstavbu NJZ	*Land for NNPP construction*
Plochy zařízení staveniště NJZ	*Land for NNPP site facilities*

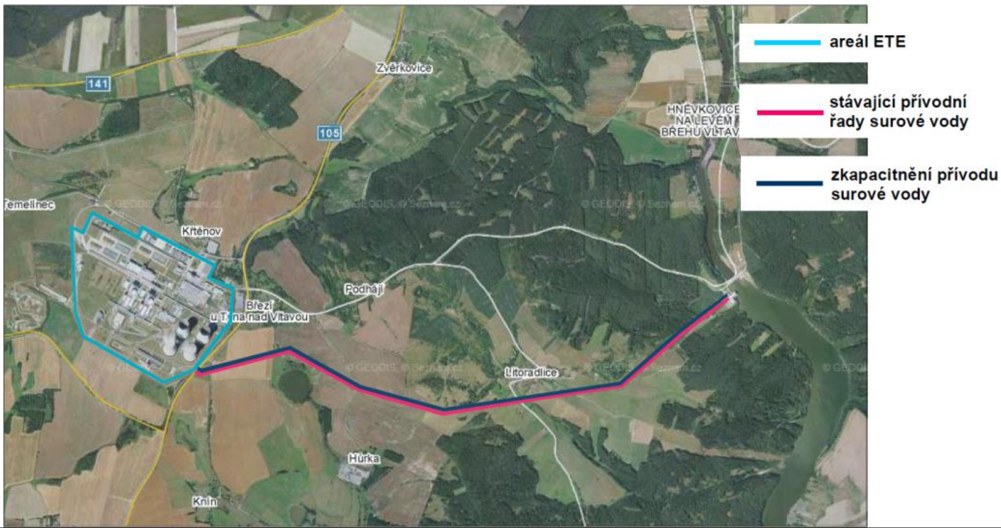
Explanation:
1 ... existing PP premises
2 ... power plant storage area
3 ... area necessary for NNPP construction
A - E ... NNPP site facilities

Figure B.I.2: Position of corridor for power output to Kočín switchyard



Areál ETE a rozvodny Kočín	TPP and Kočín switchyard complex
Koridor vyvedení výkonu z NJZ	Power output lines corridor from NNPP

Figure B.I.3: Position of corridor for raw water supplies



Areál ETE	TNPP complex
Stávající přívodní řady surové vody	Existing raw water supply piping
Zkapacitnění přívodu surové vody	New raw water supply piping

B.I.4. Project characteristics and possible accumulation with other projects

B.I.4.1. Project characteristics

The project character is the construction of a new nuclear power plant, including related structures and process equipment.

In respect of the original concept for Temelín Nuclear Power Plant, the project is to complete the power plant with modern units, including the addition of power output lines to Kočín switchyard and assumed increase in the raw water supply capacity from Hněvkovice pumping station to the power plant.

B.I.4.2. Possible accumulation with other projects

The project is located in an area adjacent to the existing NPP Temelín (units 1 and 2 and related structures and facilities). The construction, operation and potential decommissioning of the project will therefore not interfere with the operation of the existing power plant and its ensuing decommissioning. This fact is reflected in the documentation and all the impacts are assessed in their cumulative (concurrent) effect. More detailed information on the method of assessment is provided in the introduction to this documentation, specifically its subchapter Aspects of environmental impact assessment (page 49 in this documentation).

The further development of the power plant and the affected area will not be static. A repository for spent fuel from the NNPP is expected to be added to the power plant premises (when needed). Its development preparation will include an environmental impact assessment, as Act no. 100/2001 Coll. on environmental impact assessment defines it as a separate project subject to assessment (Category I, item 3.5 of Annexe 1 to the Act). This assessment will reflect the current stage of knowledge, technical quality of the repository at the time of its preparation and assess the potential accumulation of impacts in the area. Furthermore, the extension of operation of the existing power plant or increasing of its production capacity (increasing efficiency or utilisation of design reserves) cannot be ruled out. The potential capacity increases or other possible changes would be handled in accordance with legislation in force and considering environmental impacts in the area.

The concept for the development of a new 2x400 kV power line from Kočín switchyard to Mírovka switchyard is being prepared in the affected area. Kočín switchyard is thus a joint element of the power output from Temelín Power Plant (which is part of the project) and a new power line towards Mírovka switchyard (which is another investor's project). Since both the lines will depart from Kočín switchyard in opposite directions, impacts will not accumulate along them. The two projects will factually come together at Kočín switchyard, which is an area already containing a lot of technical equipment in operation, so the design for the switchyard area is influenced by technical aspects rather than environmental impact issues.

Southeast of the power plant, in Býšov (Knín cadastral area), the development of the so called Ekopark Býšov is in preparation; it will be a commercial industrial zone with predominant production and utilisation of renewable sources of energy in the form of a bioethanol facility, a photovoltaic power plant, a bio gas station, and a turbine driven by biofuels. The projects in that area are subject to an environmental impact assessment, which considers the overall state of the environment in the area. This documentation also considers the impact of Ekopark Býšov on the overall conditions in the affected area. This also concerns production, storage and transportation of bioethanol and their impacts on the safety of Temelín Power Plant.

Furthermore, a remediation and reclamation of an old environmental burden after the DIAMO state enterprise is in progress in the broader area, specifically at Mydlovary (chemical treatment plant and settling basin). Significant accumulation of these two projects is out of the question with respect to the nature of the works.

No other projects are known to be in preparation in the affected area, the nature of which might result in an accumulation of impacts with the project in question.

B.I.5. Justification of the need for the project and its location, including an overview of intended alternatives and the main reasons (including environmental) for choosing or rejecting them.

B.I.5.1. Justification of the project necessity and location

B.I.5.1.1. Project necessity and purpose justification

The project necessity is derived from the necessity of securing electricity generation in the Czech Republic.

Electricity is essentially a decentralised source of energy. It is environment-friendly in the point of end consumption (its use generates no pollutants) and its uses are versatile (it can be transformed into other forms of energy). The functioning of all spheres of the economy and living conditions of the population depend on the availability of electricity. Any potential deficiencies or failures in electricity supplies affect the entire society; the public interest in reliable electricity supplies is universally recognised.

Electricity is not a primary source of energy. It has to be generated and transported to the point of end consumption.

The electricity consumption in the Czech Republic at present (2009 data) is approximately 69 TWh a year. In spite of the current drop in consumption due to the recession, the consumption is predicted to grow to approximately 80 to 96 TWh a year by 2030, while energy intensity will decrease and savings will be made on the consumption side. The primary energy sources of the Czech Republic are limited. The chief difficulty in the near future (after 2015 to 2030) will be to substitute for a considerable decrease in domestic coal production. Along with the renewal of the capacity of power plants near the end of their useful life, this substitution has to make use of the available energy mix, which will cover the energy demand on the consumption side (having subtracted the savings). In this context, the project is a quantitatively significant, qualitatively more than reliable, environment-friendly method of electricity production that is sustainable in the long term.

The potential of the other sources (including renewable) does not cover the requirements on reliably securing the energy needs of the Czech Republic, albeit their role in the energy mix is equally non-substitutable.

Importing energy is not an alternative for covering the energy needs of the Czech Republic. The situation in neighbouring countries concerning available primary sources is comparable to that of the Czech Republic, meaning no substantial export capacities can be expected in the future.

B.I.5.1.2. Project choice justification

In order to prove the necessity of the project and substantiate the choice of the project, an analysis of the state and trend of the Czech Republic's power distribution system was commissioned along with an assessment of the benefits of the new nuclear power plants for the substitution of power plants near the end of their useful life, fuel availability and the significance of nuclear power plants as a substitute for the domestic coal sources being depleted, and a criteria assessment of four scenarios of development of the energy industry, analysed as part of the Independent Energy Committee (Pačes Committee), according to an internationally recognised set of criteria for sustainable development in the energy industry with the aim to prove both the general societal benefit of all four scenarios and the benefit of the scenario featuring the new nuclear power plant. The present assessment of the completion of Temelín Power Plant is built upon the four energy scenarios employed by the Independent Energy Committee: the base (nuclear), the base non-nuclear, the base non-nuclear with strict emission limits. They were extended with a fourth scenario: base non-nuclear coal-based (with BC extraction beyond limits), which is developed in the same parameters as the three above scenarios. This coal-based alternative of the energy mix was not verified in the energy scenario for the Independent Energy Committee, but the additional scenario is close to the one employed in the draft update of the National Energy Policy elaborated by the MIT. The range of scenarios chosen exhausts the feasible development alternatives for the Czech Republic's energy industry.

The analysis was conducted in compliance with the conclusions of the ascertainment study performed by ENVIROS, s.r.o. (Justification of the NNPP construction project. ENVIROS, s.r.o., December 2009), and its conclusions are summarised as follows:

B.I.5.1.2.1.New nuclear power plant in the context of developing the existing productive base

A considerable part of the power plant fleet within the Czech Republic's power system is nearing the end of its useful life. The first reason for nearing the end of the useful life of the productive facilities in coal power plants is their age and the stricter air protection legislation in preparation, and the changes in the system of acquiring CO_2 permits, which the operators see as a reason for their gradual decommissioning. Another, more important reason is the lack of reserved fuel for continued operation of the coal power plants. For both reasons, their operators are preparing for only a partial renewal of the productive capacities, even though they do not have fuel contracts concluded for operating the renovated units.

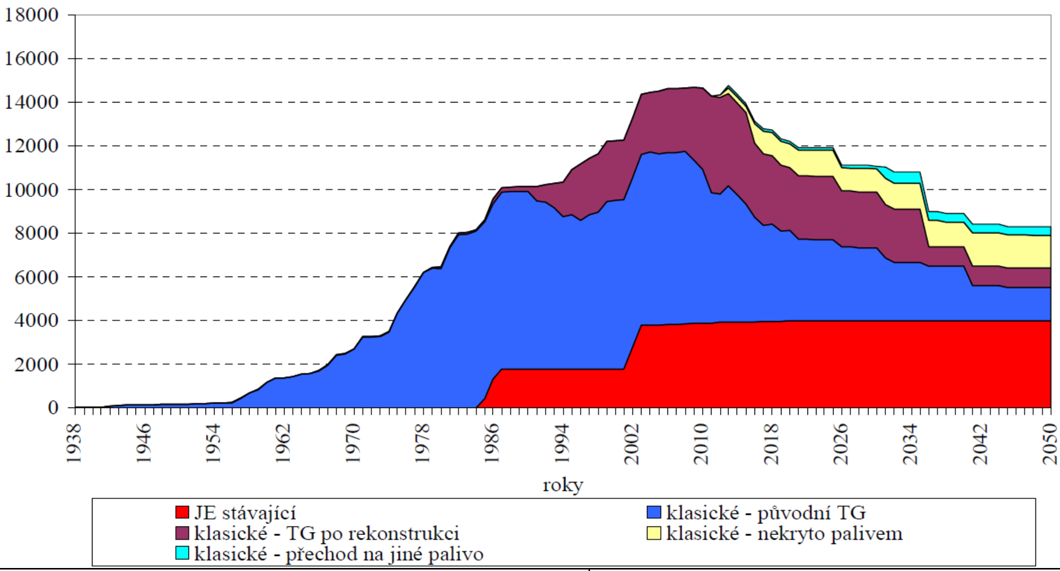
The table below shows a review of the missing installed capacity in the Czech Republic's power system as a consequence of the nearing end of the life of coal power units.

Table B.I.: Expected decreases in installed output compared to 2010 [MW_e]

	2020	2030	2040	2050
Excluding new units	-2,429	-3,573	-5,739	-6,334
Including new steam gas power plant in Počerady	-1,589	-2,733	-4,899	-5,494

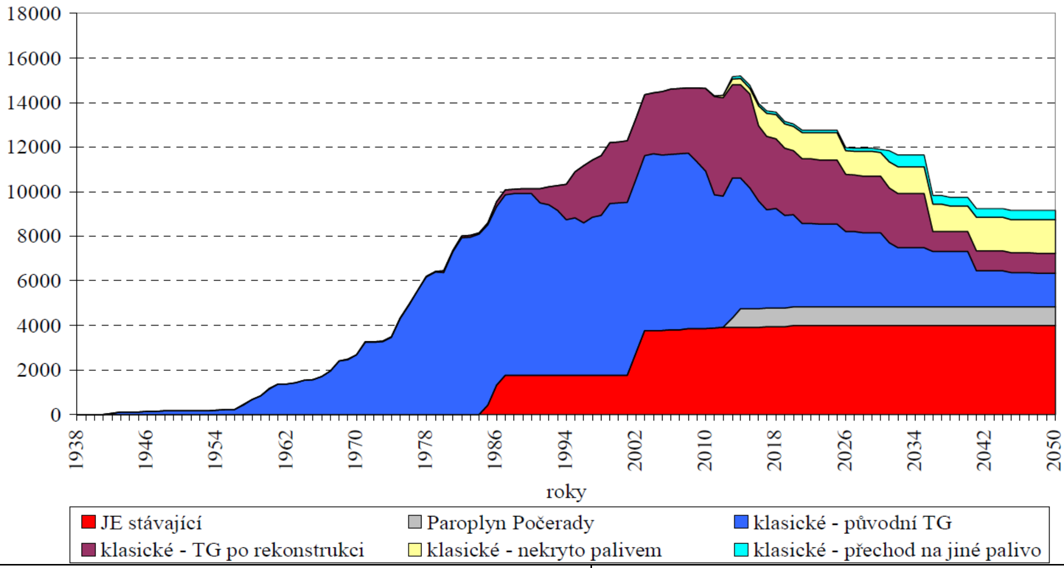
The above decreases in installed capacity are further augmented by productive capacities not secured with fuel. They will be 1090 MW in 2020; 1060 MW in 2030; 1125 MW in 2040; and 1520 MW in 2050.

Figure B.I.4: Installed capacity of turbine generators in the Czech Republic [MW_e], excluding Počerady Steam-gas Power Plant



Roky	Year
ETE stávající	Existing Temelín PP
Klasické – TG po rekonstrukci	Classical - TG after reconstruction
Klasické – přechod na jiné palivo	Classical - switch to other fuel
Klasické – původní TG	Classical - original TG
Klasické – nekryto palivem	Classical - not covered by fuel

Figure B.I.5: Installed capacity of turbine generators in the Czech Republic [MW_e], including Počerady Steam-gas Power Plant

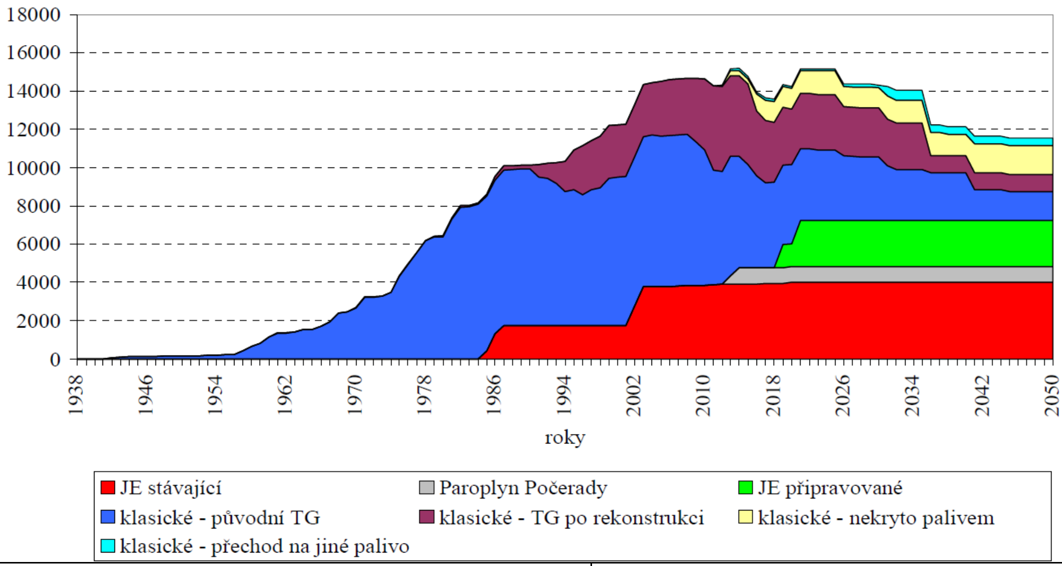


Roky	Year
ETE stávající	Existing Temelín PP
Klasické – TG po rekonstrukci	Classical - TG after reconstruction
Paroplyn Počerady	Steam-and-gas Počerady
Klasické – nekryto palivem	Classical - not covered by fuel
Klasické – původní TG	Classical - original TG
Klasické – přechod na jiné palivo	Classical - switch to other fuel

Although the decreasing trend in the installed capacity of coal power plants opens room for installation of new steam-gas sources (the first in Počerady Power Plant) and a massive advancement of renewable sources of energy, starting at the present, neither direction can cover the huge dropouts of steam (coal) unit capacity.

The useful life of the coal units is primarily shortened by insufficient availability of domestic coal. The conclusion of the analysis of the useful life of the coal power plant turbine generators is that, without the completion of a new nuclear power plant, a huge slump would occur in the installed capacities within the Czech Republic's power system, posing a threat to the safe and reliable electricity supplies in the country.

Figure B.I.6: Installed capacity of turbine generators in the Czech Republic [MW$_e$], including Počerady Steam-gas Power Plant and new NPP Temelín units



Roky	Year
ETE stávající	Existing Temelín PP
Klasické – původní TG	Classical - original TG
Klasické – přechod na jiné palivo	Classical - switch to other fuel
Paroplyn Počerady	Steam-and-gas Počerady
Klasické – TG po rekonstrukci	Classical - TG after reconstruction
JE připravované	NPP under preparation
Klasické – nekryto palivem	Classical - not covered by fuel

Even in this case, there is a clear deficit in the installed capacity, which will have to be handled by other tools (savings, new sources including renewables, and imports if necessary), each of which has certain limitations. Even full utilisation of the RSE potential in the extent assumed in the NEP and the Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee) will not fully compensate for the balance deficit that will occur in the Czech Republic's energy system after 2010 due to the massive end of the life of coal power plants.

B.I.5.1.2.2. Fuel base development in relation to the construction of the new nuclear power plant

The performed analysis of the fuel base suggests the following conclusions:

- The availability of domestic black coal is improved by way of an investment programme for mining it from great depths. The primary aim of the programme is coking coal; the share of power coal in the total production will decrease over time. The future production of black power coal will suffice for the next 20 to 25 years only for its current consumers, not for new power plants.
- The extractable reserves of brown coal are not high in respect of the assumed extraction, and are limited artificially by the territorial environmental mining limits. Even if the territorial mining limits at both the Bílina and ČSA mines are lifted, the extraction of brown coal in the CR will decrease and may only be approximately 40% of the amounts mined today in 2040. If brown coal extraction beyond the limits is not permitted, the extracted amounts will decrease more rapidly. This is a crucial impetus for an accelerated preparation of a substitute for the coal power plants near their end of life.
- Future imports cannot be ruled out today even in the case of brown coal from Poland or Germany. However, these imports can under no circumstances substitute for the decreasing extraction and end of life of domestic BC reserves. Imported brown coal would be more expensive to purchase and transport. Given its lower quality, it would call for modifications of existing boilers or new boilers.

- In the draft update of the NEP, the MIT puts a great emphasis on expanded uranium mining and processing into uranium concentrate. The uranium reserves are still abundant in the Czech Republic. Increasing uranium extraction (even in new mines) can contribute to securing the need for nuclear fuel even for expanded nuclear power plant capacities in the Czech Republic. However, the building of the new nuclear power plant in question is not associated with increased or renewed mining in formerly mined sites or even opening new mining sites. This is due to the availability of uranium in geopolitically safe places at favourable prices without having to expend great sums on transportation.
- There is a potential for utilisation of renewable energy sources in the CR. It is used in heat generation (51.2% in 2008) more than power generation at the moment. The estimates for the potential for utilisation of renewable energy sources are very optimistic: 250 PJ in 2020, nearly 350 PJ in 2030, and nearly 500 PJ in 2050. The latest development has brought many reasons for correcting the potential in either direction (biomass, wind and solar power). However, renewable sources of energy cannot fully substitute for the dropout in conventional fuels in the CR. The sources would be more costly, with considerable impacts on the operability of the power system, the environment and sustainable development. In more detail, the renewables issues are discussed in Chapter B.I.5.2.2. Project programme framework (page 98 in this documentation), specifically its subchapter B.I.5.2.2.4. Renewable electrical energy sources.
- The share of natural gas in electricity generation has been very low due to its relatively high and fluctuating prices. An increase in the gas share can be achieved by the completed design for the steam-gas power plant at Počerady. Further use of gas in the Czech energy system can be assumed primarily as a fuel for combustion in peak and semi-peak sources. Extensive use of gas in the base load segment will probably still be precluded in future by its higher price, large transport distances, the existing risk of disruption of supply, and the current relatively high share of dependence on imports from Russia.

The recapitulation of the potential of domestic sources of energy, its deteriorating long-term supply and availability of importable substitutes for the diminishing domestic sources to secure the growing electricity consumption confirms that an increased utilisation of nuclear energy accompanied with a growing share of RSE will be capable of effectively facing the long-term trends in changing availability of the various energy sources.

B.I.5.1.2.3. Construction of the new nuclear power plant in relation to international comparison

An important indicator, which was in the background of the input of expected demand for electricity in the model calculations for the scenarios of development of the energy industry, is a comparison of electricity consumption achieved per capita and per unit of GDP. The electricity consumption per capita in the CR today is at the EU27 level, but lagging behind most of the advanced EU countries. The indicator has grown by 13.5% in the CR since 2000, and it has been growing in all the countries and groups of countries. According to this indicator and the continuing convergence in the parameters of the Czech Republic's ES with the standard parameters of EU countries, the electricity consumption and production in the CR are going to continue growing.

The indicators of CO_2 production per capita and per unit of GDP are also of major importance to assessing the importance of the completion of Temelín Power Plant. The CR holds the third and fourth worst positions respectively in the two indicators. This is chiefly due to the composition of the energy mix, particularly in electricity and heat generation for central supplies, which is frequently used to criticise the CR's current energy mix. The trend is decreasing, and is going to be so due to the decreasing coal consumption. In the long term, the completion of NPP Temelín can bring it down significantly.

Other indicators do not indicate a clear positive or negative effect upon the completion of NPP Temelín in international comparison. However, they illustrate the situation and positive trends in the CR's energy industry, which is converging with the standards and parameters of the EU countries.

B.I.5.1.2.4. NNPP Impact on the fulfilment of international commitments

EU legislation and the CR's international treaty commitments in relation to the energy sector cardinally concern three areas: air protection, climate protection, and energy efficiency. The current version of the energy policy is formed by two papers: the Green Book European Strategy for Sustainable, Competitive and Safe Energy, and the European Commission Communication Energy Policy for Europe, which was part of the so called energy package in 2007. The European Strategy for Sustainable, Competitive and

Safe Energy was released on 8 March 2006. Through it, the Commission urges the Member States to implement the European Energy Policy, which should help eliminate the basic problems in the European energy sector, such as the increasing dependency on energy imports, fluctuating oil and gas prices, climate change, growing energy consumption, barriers to the formation of a common energy market, etc. The solution should help the European Union achieve its economic, social and environmental goals.

The EU Energy Policy according to the Green Book is based on three fundamental principles:

- sustainability - combating climate change by means of support to renewable sources of energy and energy efficiency,
- competitiveness - improving the efficiency of the European energy sector by setting up an internal energy market with true competition,
- safety of supplies - improving coordination of supply and demand for energy in the EU in the international context.

In the first half of 2007, the European Commission followed up on the Green Book by publishing the so called energy package. The package consists of nine interrelated documents, which establish a new conceptual framework of the energy policy for the coming decades. The future trend in the EU energy sector will thus aim at securing safe supplies of clean and competitive energy. The basic pillars of the new energy policy, which fully respect the proposals in the Green Book, are as follows:

- combating climate change,
- reducing external dependence of the EU on energy supplies of oil and natural gas,
- support to competitiveness.

The Commission proposes the following strategic objectives:

- in international negotiations, reduce the greenhouse gas emissions in advanced countries by 30% until 2020 compared to 1990; and reduce global emissions by up to 50% until 2050 (by 60-80% in advanced countries),
- a unilateral commitment of the EU to achieve an emission reduction by at least 20% by 2020 regardless of the results of international negotiations.

The construction of the new nuclear power plant as part of the Czech Republic's energy sector, which is part of the European energy sector, is in line with the principles and pillars of the EU Energy Policy and the new EU energy package, and directly supports the basic strategic goals that the Commission has proposed.

A virtually emission-free source, the nuclear energy sector clearly contributes to both reducing greenhouse gas emissions and reducing emissions of substances causing environmental acidification and substances detrimental to health. Nuclear energy is a competitor for renewable sources of energy to some extent, yet on the other hand, its mere existence as a robust source working in the base load segment with improved controllability in the newer units, it allows the effective and safe integration of renewable sources into the resulting optimal mix of energy sources.

Nuclear energy has no immediate impact on energy efficiency in end consumption. The efficiency of electricity generation in the new nuclear power plant will be lower than in fossil fuel sources due to the lower operating temperatures of the steam cycle. Given the availability and prices of nuclear fuel, this does not pose a major problem. There is a certain potential for increasing the efficiency of nuclear power plants in the utilisation of heat from the nuclear power plants for deliveries to cities[1].

The construction of the new nuclear power plant can be regarded as a contribution to climate protection and air protection.

B.I.5.1.2.5. Criteria assessment of scenarios for development of the energy industry

The quantification of benefits and costs of the scenarios for development of the energy industry employs a set of internationally employed sustainable development criteria pursuant to the Energy Indicators for

[1] Specifically in the case of Temelín Power Plant, the taking of this opportunity would mean a chance to revive the original project of delivering heat to the South-Bohemian capital of České Budějovice.

Sustainable Development: Guidelines and Methodologies (International Atomic Energy Agency, United Nations Department of Economic and Social Affairs, International Energy Agency, Eurostat and European Environment Agency. April 2005). The criteria can be used both for assessing the trend in one development scenario (criteria improve, deteriorate or stagnate over time) and for comparison of multiple development scenarios. The selected set of criteria is further divided into three spheres of aspects of development of the energy industry: social, economic, and environmental. The criteria were quantified for all four assessed scenarios for development of the energy industry, analysed by the Independent Energy Committee (Pačes Committee).

Social aspects

The share of expenditures on energies in the total household expenditures is nearly 14% above the EU27 average at present. This is due to essentially identical prices of electricity, natural gas and heat at generally lower income, thus lower household expenditures. Both energy prices and household income will grow in future, so a gradual convergence of the share with the EU27 average can be expected. The electricity price under the nuclear scenario can be expected to be up to CZK 600/MWh lower than under the other scenarios.

The indicator of the probable number of deaths due to serious accidents decreases under all the scenarios: to approximately one half under the non-nuclear scenarios and approximately one quarter under the nuclear scenario.

Employment in energy industries will decrease under all the scenarios. The decrease will be by approximately 30 thousand persons by 2050, which is 55% of the initial number. The decreasing employment will be mostly due to the phase-out of brown and hard coal extraction. There are minor differences among the scenarios; the lowest employment decrease is under the coal-based scenario. The adverse effect is that workforce will become unemployed in regions where the unemployment is already above average. The reduction in jobs in the energy sector may be partially set off by creation of jobs in other sectors. New jobs may be created particularly in mechanical engineering manufacturing energy equipment for utilisation of renewable sources of energy, agriculture for growing energy biomass, and in restoration and development of nuclear engineering.

All the scenarios assume a significant decrease in air emissions of substances detrimental to human health, which will lead to reduced illness and extension of life expectancy. The coal-based scenario is not favourable in this sense; the other three scenarios assume more pronounced emission reductions and differ little from each other. This criterion is favourable under the nuclear scenario.

Concerning social aspects, the construction of the new nuclear power plant is favourable in two criteria and virtually equivalent to the other scenarios in two more criteria.

Economic aspects

The construction of the economic criteria is largely based on consumption of primary energy sources, final energy consumption, and the electricity generation structure. All four scenarios compared were constructed so that they cover an identical demand for energy. That is why all four scenarios have an almost identical final energy consumption, only differing slightly in the structures of fuels and energies in the final consumption and the degree of implementation of savings measures on the demand side. The criteria related to the final consumption therefore hardly differ across the scenarios. The differences among the scenarios are chiefly in the different compositions of sources for electricity and heat generation.

In all the scenarios, the final energy consumption per capita shows an identical growing trend with a gradually slowing rate of growth. The only segment where an absolute decrease in the final energy consumption is households, where the decrease is due to the rapid building insulation. The electricity consumption per capita shows a very similar trend. An absolute decrease in electricity consumption is not assumed in any segment. The consumption of primary energy sources per capita shows a moderate growth to stagnation, and the scenarios differ. Given the lower efficiency of nuclear power plants (due to lower steam temperatures), the consumption of primary energy sources per capita is higher than in the other scenarios. The scenario with natural gas and renewable sources of energy makes the best performance.

The energy intensity of the national economy shows a rapid decrease in all of the scenarios due to the growing GDP in the fraction denominator. That is also the cause of the negligible differences in the indicator values across the scenarios for consumption of primary energy sources, final energy consumption and final electricity consumption.

Among energy generation and transportation efficiency indicators, the scenarios differ in their rates of efficiency of generating electricity from fossil fuels. It increases from the initial 45% to 53% in the coal-based scenario and up to 68% in the nuclear scenario. In addition to technological advances, the chief reason for the growing efficiency of electricity generation from fossil fuels is the elimination of part of the condensation production, so the system has a higher share of combined heat and power plants. No major changes are assumed in the sphere of loss in energy transfer and distribution, so the scenarios do not differ there.

As concerns the share of annual extraction and extractable, or total estimated reserves of energy sources, domestic oil and natural gas reserves make a negligible contribution to the annual consumption of these primary energy sources; the extractable hard coal reserves will last till approximately 2040 with the gradually decreasing extraction, and the extractable brown coal reserves will last till approximately 2050 with the steeply decreasing extraction, while it is possible to extend them till 2075 if the territorial environmental limits are breached. The economic reserves of hard coal are about 2.5 times the extractable reserves. The economic reserves of brown coal are about 1.5 times the extractable reserves; the total geological reserves are about 2.5 times the extractable reserves. As concerns the speed of depleting the domestic reserves of brown and hard coal, the scenarios hardly differ (except the coal-based one) since coal primarily satisfies the heat-generating needs. A supply of heat from nuclear power plants might extend the life of the coal reserves. The uranium reserves in the CR are substantial: the extractable amount is about 56 thousand tonnes, the geological amount is about 125 thousand tonnes. The scenarios did not calculate with this uranium: they assumed net imports of ready-made nuclear fuel.

The energy and electricity intensities of the economic domains (industry, agriculture, transport, and services) show decreasing trends, and the scenarios do not differ in these indicators. There was a slight difference in the electricity intensity of households, where the higher price of electricity in the non-nuclear scenario with gas and renewables caused a decrease in the electricity intensity by up to 150 kWh/household compared to the nuclear scenario. The overall energy intensity of the households did not change, so this was a change in the energy carrier.

The diversification of the sources in primary energy consumption is sufficient in all the scenarios. The highest share of a single energy carrier is 32%, namely for gas in 2035 in the non-nuclear scenario with gas and renewables. None of the energy carriers are so dominant that potential problems with its supply would entirely paralyse the functioning of the energy industry. The situation is analogous for the structure of the final energy consumption. Again, natural gas shows the highest share (32%) and the scenarios hardly differ in this indicator. Concerning electricity generation, nuclear power plants show up to 55% in the nuclear scenario in 2025; the corresponding share in the installed capacity is 26%. Renewable sources show a high share in electricity generation in 2050: from 37% in the nuclear scenario to 44% in the non-nuclear scenario with gas and renewables. A high share of renewables will make increased demands on the controllability of the power system.

The energy prices for end consumers will grow in future. This is due to growing prices of fuels and technologies, impacts of emission trading, emission fees, and last but not least, the increasing share of renewable sources of energy in both electricity and heat generation. A higher share of nuclear sources contributes to lower prices of electricity; it will not project itself too much in heat prices. The comparison of the scenarios is favourable to the nuclear alternative; the other scenarios are virtually equivalent. In the nuclear scenario, electricity is CZK 700/MWh and CZK 600/MWh cheaper for households and industry respectively. The coal-based scenario would provide the cheapest heat.

The share of carbon-free energy carriers in the domestic consumption of primary energy sources as well as electricity generation increases in all the scenarios; the nuclear scenario clearly shows the greatest increase. Likewise, the share of renewable sources in the domestic consumption of primary energy sources as well as electricity generation increases in all the scenarios; nevertheless, none of the scenarios guarantees fulfilment of the commitment for 13% of renewable sources in the final consumption. The scenarios begin to differ from 2025 onwards; the nuclear scenario has the lowest share of renewables.

The energy dependency on imports increases from an initial 42% to 80% in 2040. The utilisation of domestic brown coal would temporarily reduce the dependence on imports by about 10%. The utilisation of renewable sources contributes to a permanent reduction in the energy dependence on imports. Due to the methodology used (enrichment and processing outside the CR), nuclear fuel is calculated as a net import although a considerable part of it originates from Czech mines. In terms of geographical security of imports (political stability, technical condition of infrastructures), gas importation is more difficult (Russia, post-Soviet countries, Iran, etc.) than nuclear fuel importation (again Russia, but also France, USA, UK).

When assuming the opportunity to secure most of the uranium mined from national resources, the nuclear scenario is seen as beneficial in almost one half of the economic indicators. In the other criteria, the nuclear scenario is equivalent to the other scenarios. An exception is the consumption of primary energy sources per capita due to the lower efficiency of energy transformation in nuclear power plants.

Environmental aspects

All the scenarios guarantee fulfilment of the CR's existing commitments to reduce greenhouse gas emissions with a leeway. The contribution of the new nuclear power plant to reducing greenhouse gas emissions is substantial: the decrease in greenhouse gas emissions per capita is 15% more in the nuclear scenario than in the non-nuclear one, and 4% more than in the gas and renewables scenario.

Air protection will improve substantially under all the scenarios. SO_2 emissions will decrease by 60 to 70% by 2050; NO_X emissions, by 47 to 53%. In this respect too, the new nuclear power plant guarantees the greatest emission decreases.

In water protection, underground and open-cast coal mining is the main risk factor. Given the decreasing extraction trends, the amounts of wastewater discharged will decrease. The pumping of pit waters will partly continue even after the underground coal mining ends because it is connected with the formation of methane and expelling it from the mines; it therefore performs a protective function. The coal-based scenario would result in increased wastewater generation from open-cast mining; the other scenarios are virtually equivalent.

The solid waste generation is mostly connected to combustion of coal and biomass and operation of exhaust desulphurisation equipment. Most of the solid waste from coal combustion and desulphurisation is classified as energy by-products and used in land reclamation, road building, etc. Only about 2% of these materials is stored in repositories. The solid waste generation will decrease along with the decreasing use of coal. The coal-based scenario shows a higher solid waste generation; the other scenarios are virtually equivalent.

The generation of nuclear waste is specific to nuclear energy only. This is solidified low-activity and medium-activity waste. The generation of this waste is in direct proportion to the electricity generation in nuclear power plants, and is therefore the highest in the nuclear scenario. Spent nuclear fuel is a special story, as it may or may not be qualified as high-activity nuclear waste depending on the potential future reprocessing.

Land occupation is connected with land required for the construction of generating facilities, but mostly with coal mining again. The land occupation in the nuclear scenario is only about 300 ha less than in the non-nuclear and the gas and renewable scenarios. In contrast to that, the coal-based scenario would call for approximately 3,000 ha more land occupation. On the other hand, the extension of coal mining would continue to generate resources for reclaiming land affected by previous mining.

Summary of the criteria assessment of scenarios for development of the energy industry

All the scenarios assessed guarantee a positive trend in the overwhelming majority of the assumed sustainable development indicators. It can therefore be claimed with a high degree of probability that all the scenarios tend towards fulfilling the purpose and goals of sustainable development in the energy industry.

The mutual comparison of the scenarios naturally is not (and cannot be) unequivocal, but it does provide favourable results for the scenario featuring the completion of the nuclear power plant in all the three spheres of the comparison criteria. The nuclear scenario poses the lowest real risks, the lowest price of electricity generated, and the lowest environmental burden of all the scenarios compared.

B.I.5.1.3. Justification of economic, social and political context of project necessity

The project is in compliance with the Territorial Development Policy of the Czech Republic (TDP) passed by Government Resolution no 929/2009 of 20 July 2009.

The project is in compliance with the National Energy Policy of the Czech Republic (NEP) passed by Government Resolution no 211/2004 of 10 March 2004. Moreover, the project satisfies the conclusions of the Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (IEC), established based on Government Resolution no. 77/2007 of 24 January 2007, which is the basis for the update of the National Energy Policy.

In all the above papers, the project is one of the assumed alternatives of electricity generation and an important part of the energy mix together with savings.

B.I.5.1.4. Justification of project applicant's qualifications

The project applicant, ČEZ, a.s., is one of the most prominent electricity producers in the Czech Republic, representing a share of approximately 73% total production and approximately 55% in production from renewable sources. It is also the only operator of nuclear power plants in the Czech Republic, which make up approximately 21% of the installed capacity and approximately 43% of the total production of electricity (2008 data).

Both the nuclear power plants owned and operated by ČEZ, a.s., (Dukovany Power Plant and Temelín Power Plant) have long been operated in compliance with licensing conditions and under the supervision of both national (SONS) and international (IAEA) authorities. The operator's experience and know-how gained from the preparation, construction and commissioning of the nuclear units, along with the so far safe and reliable utilisation of the nuclear units for over 109 reactor years (with no occurrences of INES 2 or higher events over this time) confirm the operator's qualification for operating the new nuclear power plant.

B.I.5.1.5. Project capacity justification

The project capacity is based on both the expected trend in demand for electricity in the Czech Republic (for the foreseeable period) and the limitations due to the project location.

The project capacity (up to 3400 MW_e of installed capacity) is within the expectable trend in demand for electricity in the Czech Republic, considering the development of the productive base, the availability of primary energy sources, and the potential for renewable sources or energy savings (see Chapter B.I.5.1.2. Project choice justification). In respect of future requirements of the Czech Republic's power generation network, it thus leaves room for the implementation of other sources of energy (including renewable) and demand-side measures (savings).

Standard units with a capacity much below 1000 MW_e are not supplied for commercial applications at present. Standard commercially available monoblock units with a capacity of at least 2x1000 MW_e are assumed for the project. A minimum capacity limited in this way respects the original concept for Temelín Power Plant (4x1000 MW_e); it also permits utilisation of available units of higher capacity while respecting limitations for which the site has been verified and confirmed to be appropriate.

B.I.5.1.6. Project location justification

The project is to make use of the existing site of the power plant in operation with the aim to respect the concept of the original project for four reactors for which the site was chosen and designed, and the construction of which had commenced, however, it was then reduced to two reactors only. Compared to choosing a different site that might be considered for locating the project, this approach within the scope of the Czech Republic minimises the impacts of the construction and operation.

The site is appropriate in terms of both requirements on the location of a nuclear energy facility and availability of necessary space and infrastructure and process connections. In this respect, the project location makes an effective use of available resources.

B.I.5.1.7. Justification of design of associated parts of the project

The associated parts of the project (power output to Kočín switchyard, and the assumed raw water pumping line from Hněvkovice pumping station) are designed in a way to cover the capacity demand of the new power plant. They respect the existing design of both the power output and the raw water collection and are their continuation in the spatial sense.

B.I.5.2. Overview of alternatives considered

The overview of alternatives considered is divided into:

- a description of the project alternatives (page 96 in this documentation),
- a description of the project programme framework (page 98 in this documentation), and
- a description of the zero alternative (page 121 in this documentation).

This division is chosen due to having to distinguish between the subject matter of the project (and its potential alternatives) and other facts of which the project is a partial framework component but which are of a society-wide nature (thus not being direct alternatives of the project).

The description of the project alternatives is related to the project, which is a new nuclear power plant at Temelín. The selection of alternatives is in the direct capacity of the project applicant.

The description of the project programme framework contains various energy, economic, political, social and other contexts of which the project is a partial framework component but which are not a direct alternative of the project. The programme framework is not in the direct capacity of the project applicant; it is the subject of national or other strategies and facts.

The zero alternative comprises a description of the consequences of not implementing the project.

B.I.5.2.1. Project alternatives

The proposed project has a single implementation variant, consisting in the construction of a new nuclear power source at the Temelín site including power transmission to the Kočín switchyard. The justification of the necessity and location of this alternative is made in subchapter B.I.5.1. Justification of the project necessity and location (page 86 in this documentation).

Other project variants are not discussed in the documentation. Information on the choice of the alternative are discussed below in the following scope:

- project location alternatives,
- project technical design alternatives, and
- project component alternatives.

B.I.5.2.1.1. Project location alternatives

The project is located on a site immediately adjacent to the existing Temelín Power Plant in operation.

The construction of Temelín Power Plant was originally (in 1980) decided following an expert selection of the site, featuring four units with VVER 1000 reactors. The site decision procedure held in 1985; the construction permit was issued in November 1986. The construction of the power plant process structures commenced in February 1987. After 1989, the new political and economic context led to a revision of the necessity of 4000 MW of capacity and the Government of the Czech Republic issued Resolution no. 109 of 10 March 1993 ruling to complete NPP Temelín with two units only. Following its repeated discussion, the Government issued Resolution no. 472 of 12 May 1999 approving the completion of both NPP Temelín units. The power plant was put into operation gradually: unit 1 in 2002 and unit 2 in 2003.

The Temelín site therefore has the space and infrastructures required for the location of the new nuclear power plant, which is the chief reason for locating the project there. The two new units practically fulfil the original concept of building a nuclear power plant at Temelín with four units. No other site that would meet these requirements is available for the project, meaning none is assessed.

B.I.5.2.1.2. Project technical design alternatives

The proposed project has a single alternative, consisting in the construction of a new nuclear power plant at Temelín, including power output to Kočín switchyard. This alternative can be implemented in multiple versions (technical solutions).

Study work preceding the environmental impact assessment included an analysis of latest nuclear power plant units abroad that were put into operation recently or the construction and commissioning of which is scheduled for the near future. These are 3rd generation power plant units. This new generation makes use of operating experience with current nuclear power plants (over 5,000 reactor years in operation) and enhances the verified design elements with additional technological improvements. Compared to 1st and 2nd generation units, the modern technologies also make it possible to simplify the units considerably. For example, a reduction in the number of loops in the primary circuit results in reduced pipeline length and numbers of actuating units that might fail. Another very important property of these units is their increased application of passive safety elements, making it possible to cool down the active zone even if the power supply fails. In summary, 3rd generation reactors show improved safety and reliability, will have a longer useful life, better utilisation of nuclear fuel, and improved economic efficiency of operation.

Units with pressurised water reactors (PWR) will be used for the project, while none of the available types of pressurised water reactors complying with all terms specified by the decisions of regulatory authorities is excluded. Some of the following alternatives are assumed as reference[1]:

- EPR - European pressurised water reactor supplied by AREVA, the commissioning of which at Olkiluoto power plant in Finland is scheduled for 2011; another EPR should start the gradual renewal of EdF nuclear power plants in Flamanville 3 PP in France in 2012,
- AP1000 pressurised water reactor developed by Westinghouse, the design for which was approved by U.S. NRC in 2004; they are currently being built in the USA and China,
- pressurised water reactors derived from the well-tested Russian VVER 1000 concept, represented by the AES-2006 (traded as MIR-1200), which are in various stages of bidding, project preparation and construction in Russia and other countries,
- EU APWR pressurised water reactor developed by Mitsubishi Heavy Industries, Ltd., based on the currently licensed design for Tsuruga NPP in Japan, 2x1538 MW_e.

These various technical designs do not represent project alternatives among which a choice should be made within an environmental impact assessment. The environmental, as well as safety requirements for all the reactor types are identical and the impacts are considered in their potential maximum.

Pursuant to Act no. 37/2006 Coll. on Public Contracts, as amended, which concerning entities in the energy sector, is fully in compliance with Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors, as amended, ČEZ, a.s., is therefore obliged to select the contractor using a bidding procedure that must not exclude any manufacturer in advance.

This statute does not factually prevent the current performance of an environmental impact assessment based on the common properties and presumable technical designs. The parameters of the subsequently chosen design will then be better (or at least identical) in all the indicators than the parameters used in the environmental impact assessment. This attitude also makes it better possible to meet the requirement on the technical and safety parameters of the power plant being in line with the currently attained level of knowledge at the time of its licensing procedure.

Whichever manufacturer wins the bidding with whichever technical design, the equipment delivered will comply with all the requirements of legislation, in particular Act no. 18/1997 Coll. on peaceful utilisation of nuclear energy and Ionising radiation (the Atomic Act), as amended, and the associated decrees. The compliance of the chosen technical design with the requirements of the Czech Republic's legislation shall be authenticated by the Czech Republic's supervisory authority, i.e., the State Office for Nuclear Safety, as part of the licensing procedure. If the technical design fails to comply with the requirements, the SONS will not license it and it cannot be used.

B.I.5.2.1.3. Project component alternatives

The additional project components, leaving the power plant site (i.e., the power output to Kočín switchyard and the assumed increase in the capacity of the raw water mains from Hněvkovice pumping station) are not designed in alternatives. They follow existing corridors, which condition their locations.

[1] The appropriateness of this choice of reference units is documented by the first round of the selective bidding, attended by suppliers of three of the reference units listed here. They were the AP1000, AES-2006 (traded as MIR-1200) and EPR units. The supplier of the EU-APWR unit, Mitsubishi Heavy Industries, Ltd., did not attend the first round of the selective bidding.

B.I.5.2.2. Project programme framework

The project programme framework comprises various contexts that are substantial to the project but do not represent direct project alternatives among which a choice should be made within an environmental impact assessment.

The project programme framework is structured as follows (see the text below for more details):

- Political and strategy papers
  - Energy Policy of the Czech Republic
  - Territorial Development Policy of the Czech Republic
  - National Energy Policy of the Czech Republic
  - Report of Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee)
- Non-renewable electrical energy sources
  - Fossil fuel power plants
- Renewable electrical energy sources
  - Hydroelectric power plants
  - Wind power plants
  - Biomass power plants
  - Geothermal power plants
  - Photovoltaic power plants
  - Other renewable sources
- Nuclear power
  - Nuclear power plants
  - Nuclear power in the world
- Potential for savings
- Hydrogen production in the nuclear power plant
- Greenhouse gas emissions
- Comparison of radioactive emissions from conventional and nuclear power plants

B.I.5.2.2.1. Political and strategy papers

Energy Policy of the Czech Republic

The Energy Policy, passed by Government Resolution no. 50/2000 of 12 January 2000, was the first modern-era strategic paper elaborated for the independent Czech Republic. In the sections on development of nuclear energy, it claimed that nuclear energy may make a substantial contribution to the fulfilment of the UN Framework Convention on Greenhouse Gas Emission Reduction. Further advances in nuclear energy are one of the possible methods of covering electricity demand after 2015 and shall be assessed in the context of economic and environmental exploitation of coal deposits and forecasts of demand for final energy consumption and, within that, demand for electricity. Any construction of a new nuclear power plant after 2015 has to be both acceptable to the public and competitive. The goals were defined as follows:

- by means of state representatives in managing bodies of ČEZ, a.s., ensure the completion of NPP Temelín [1] while respecting deadlines for supplying the reactors with nuclear fuel and the price,
- ensure the modernisation and increasing safety of Dukovany Nuclear Power Plant,
- ensure protection of significant uranium ore resources for potential future exploitation.

[1] This concerned the completion of the first two units of the power plant.

Territorial Development Policy of the Czech Republic

The Territorial Development Policy (TDP) is a land-use planning instrument that defines requirements and frameworks for specification of land-use planning tasks in the national, transboundary and international context laid out generally in the Building Act, particularly with respect to sustainable development of the territory. Among other things, the Territorial Development Policy coordinates projects for changes in the territory of national importance for transport and technical infrastructures and sources of the component systems of technical infrastructures the importance, extent or assumed utilisation of which will affect the territory of multiple regions.

The 2008 Territorial Development Policy of the Czech Republic, passed by Government Resolution no. 929/2009, includes delineations of areas for extensions, including electrical and heat power output, of Temelín, Ledvice, Počerady, Prunéřov, Tušimice, Dětmarovice, Mělník, and Dukovany power plants. The reason for the delineation is land safeguarding for the renewal of existing sources or construction of new sources on sites with appropriate geographical conditions and required public infrastructures and conditions for evacuating their power to the transmission network.

The project for the new nuclear power plant at Temelín is in compliance with the Territorial Development Policy of the Czech Republic.

National Energy Policy of the Czech Republic

The National Energy Policy (NEP) is among the fundamental components of the Czech Republic's economic policy. It is a manifestation of the State's responsibility for creating conditions for reliable and long term safe supplies of energies at affordable prices and for creating conditions for their efficient utilisation that will not threaten the environment and will be in compliance with sustainable development principles. The State fulfils this statutory responsibility by defining the legislative framework and rules for the operation and development of the energy industry. The Policy was passed by Government Resolution no. 211 of 10 March 2004.

The National Energy Policy vision specifies the national priorities and sets targets that the State wants to achieve in influencing the development of the energy industry with a perspective for the next 30 years under the conditions of a market-oriented economy. The choice of priorities, targets and set of tools of the National Energy Policy respects energy, environmental, economic and social aspects. The National Energy Policy vision is derived from the basic priorities, which establish a framework for the long-term development of the Czech Republic's energy industry. The basic priorities of the National Energy Policy is to maximise:

- independence (independence of foreign sources of energy, independence of sources of energy from risky areas, independence of reliability of supplies from foreign sources),
- safety (safety of sources of energy including nuclear safety, reliability of supplies of all types of energy, rational decentralisation of energy systems), and
- sustainable development (environmental protection, economic and social development).

The Policy defines these priorities with four goals (comprising several partial goals) aiming at fulfilling its vision and elaborating the basic priorities into a more specific form. The goals (in the order of importance) and their partial goals are as follows:

- maximise energy efficiency:
  - maximise energy valuation,
  - maximise efficiency of acquiring and transforming energy sources,
  - maximise heat savings,
  - maximise efficiency of appliances,
  - maximise efficiency of distribution systems,
- secure effective quantity and structure of consumption of primary energy sources:
  - support electricity and heat generation from renewable sources of energy,
  - optimise utilisation of domestic energy sources,
  - optimise utilisation of nuclear power,
- ensure maximum environmental friendliness:
  - minimise emissions harming the environment,
  - minimise greenhouse gas emissions,

  - minimise environmental burden on future generations,
  - minimise environmental burden from the past,
- finalise the transformation and liberalisation of the energy industry:
  - finalise transformation measures,
  - minimise the price level of all types of energy,
  - optimise back-up energy sources.

It follows from the above list that optimisation of utilisation of nuclear energy is one of the partial goals of the National Energy Policy. It is a goal of high priority aimed at optimising the share of nuclear energy in the long term safe energy mix, while respecting the necessary requirements on the safety of its operation. The fulfilment of this goal contributes to reducing the environmental burden in the CR, including reducing greenhouse gas emissions. The nuclear energy sector will also support the priorities of maximising the nation's independence on sources of energy from risky areas and maximising the nation's independence on reliability of supplies of foreign energy sources. Fuel for nuclear power plants can be obtained on markets in politically stable areas and its stocks can be generated and maintained over very long periods of time.

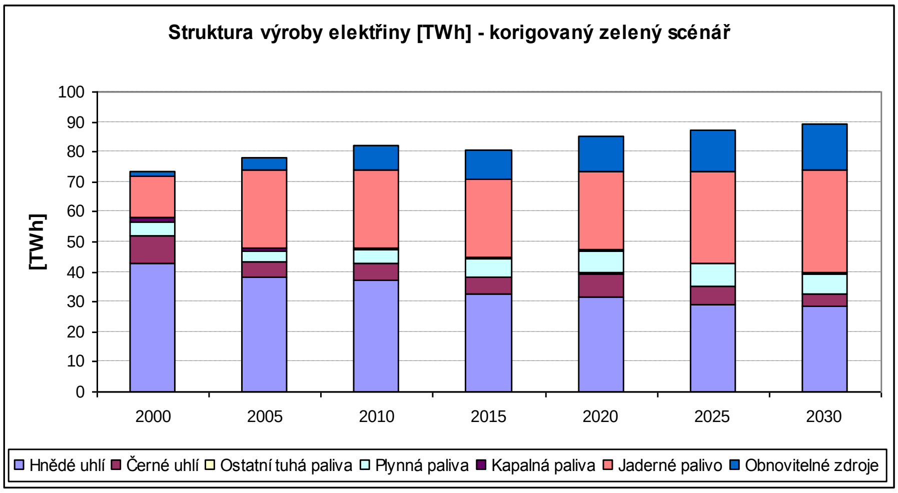
Furthermore, the National Energy Policy contains a comprehensive energy scenario, approved by the above quoted Government Resolution no. 211 of 10 March 2004. This approved scenario is the outcome of model calculations for 2002-2035; approximately 40 different scenarios and sensitivity analyses were examined. The scenarios were compared using multi-criteria analysis; the recommended and Government-approved so called “green scenario” is a decision based on the following facts:

- no primary energy source is blocked administratively,
- the scenario provides entities in the energy sector with the broadest supply of energy sources,
- the scenario assumes the lowest imported energy intensity and the least impacts on employment reduction,
- out of all the scenarios, it provides the most insight beyond 2030, as the increased availability of brown coal reserves is capable of securely supplying the new generation of coal power plants that will substitute for the current coal power plants after 2010,
- the scenario is the most resistant to fluctuating global prices with favourable impacts on prices of electricity and heat from large heating plants, because domestic brown coal extraction has the most transparent costs,
- the scenario is most in line with the Czech Republic's historic tradition,
- the scenario is the most frequently recommended alternative in the public debate of the draft National Energy Policy.

The development of new findings and recommendations arising from the public debate led to a new calculation of the “green scenario”, which reflected these new facts. The new calculation is referred to as the “green scenario – R”, or “revised green scenario”. This revised scenario enhances the role of savings, renewable sources and natural gas to the detriment of solid, liquid and nuclear fuels.

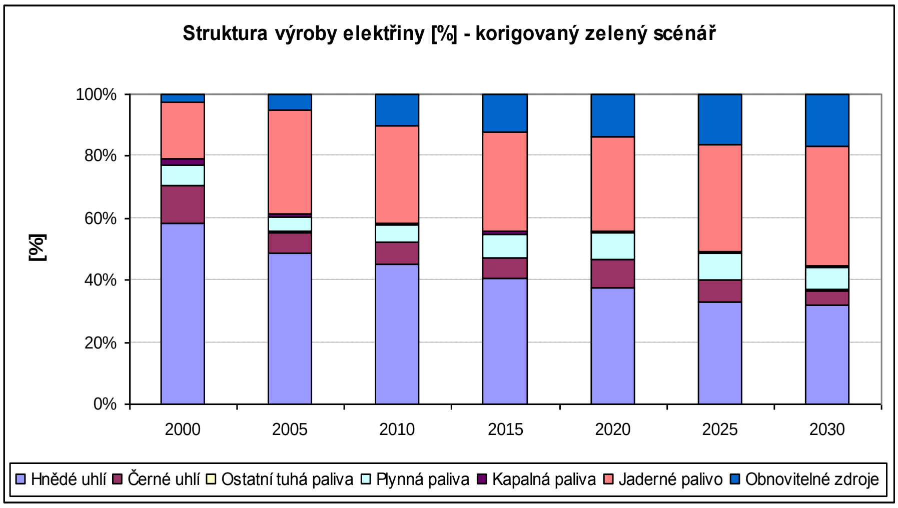
The anticipated quantity and structure of electricity production under the “revised green scenario” of the National Energy Policy is evident from the charts below:

Figure B.I.7: Power generation structure [TWh] - revised green scenario



Struktura výroby elektřiny (TWh) – korigovaný zelený scénář	**Electricity generation structure [TWh] - revised green scenario**
Hnědé uhlí	Brown coal
Černí uhlí	Black coal
Ostatní tuhá paliva	Other solid fuels
Plynná paliva	Gaseous fuels
Kapalná paliva	Liquid fuels
Jaderné palivo	Nuclear fuel
Obnovitelné zdroje	Renewable resources

Figure B.I.8: Power generation structure [%] - revised green scenario



Struktura výroby elektřiny (%) – korigovaný zelený scénář	**Electricity generation structure [%] - revised green scenario**
Hnědé uhlí	Brown coal
Černí uhlí	Black coal
Ostatní tuhá paliva	Other solid fuels
Plynná paliva	Gaseous fuels
Kapalná paliva	Liquid fuels
Jaderné palivo	Nuclear fuel

Obnovitelné zdroje	Renewable resources

The new nuclear power plant project at Temelín is therefore in compliance with the goals of the National Energy Policy, aimed at optimising the share of nuclear energy and increasing that share in the long term safe energy mix, while respecting the necessary requirements on the safety of its operation.

Report of Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee)

The Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (abbreviated to Independent Expert Committee, IEC) was established based on Government Resolution no. 77 of 24 January 2007. Václav Pačes, Chairman of the Academy of Sciences of the CR, was appointed Chairman of the IEC (hence the title Pačes Committee). The Committee was asked by the Government to revise the past energy policies of the Czech Republic and the potential implementation of the current Government Programme Declaration concerning energy, and based on independent expert analyses, it advised the Government on further steps in securing the CR's energy needs. The Commission focused primarily on long-term strategies, and their projected implementation, which exceed the duration of one electoral term. The primary motivation for the IEC was an effort to:

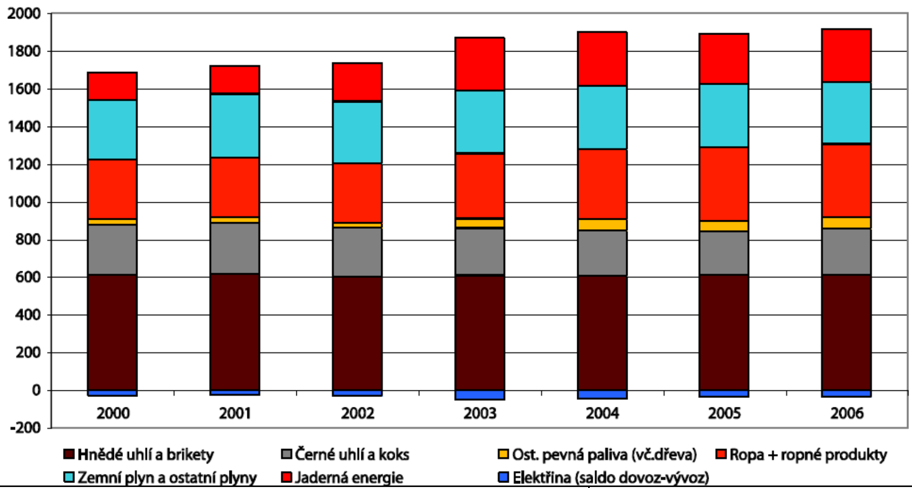
- reduce the CR's energy intensity,
- satisfy the societal development with energies,
- motivate for investment in cutting-edge innovation and emission reductions, and
- reduce the risks of power supply to the CR.

The Committee assessed the energy issues from all perspectives: economic, environmental, safety, and social. Its forecasts are conceived with a prospect until 2030 and 2050. The Committee's Report is a comprehensive paper, mapping the perception of the Czech Republic's energy sector in a broad context; in addition to summarising the analyses and possible scenarios, it also presents a perspective on the energy sector as a social phenomenon, a strategic industry without which the life of a modern society is not possible.

The analysis of the Czech Republic's energy sector quoted in the Pačes Committee Report makes the following conclusions:

The consumption of primary energy sources has been showing a moderately growing trend in recent years, while the energy intensity of the economy has been decreasing. Both the indicators are plotted in the charts below.

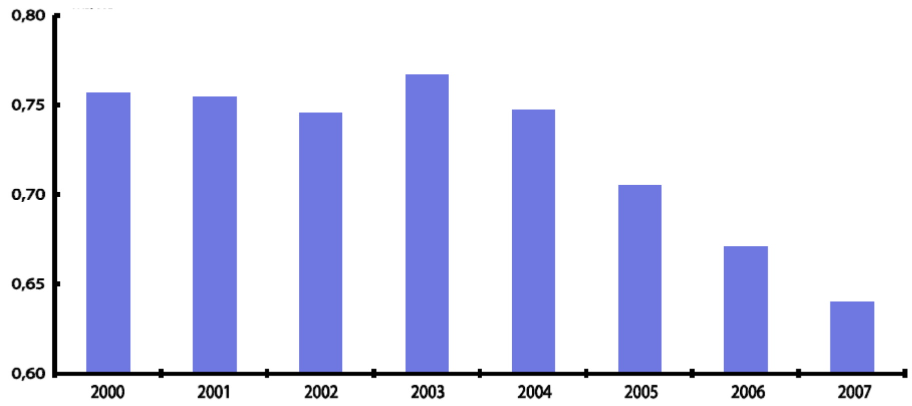
Figure B.I.9: Consumption of primary energy sources in the Czech Republic [PJ]



Hnědé uhlí a brikety	Brown coal and briquettes
Zemní plyny a ostatní plyny	Natural gas and other gases
Černé uhlí a koks	Black coal and coke
Jaderná energie	Nuclear energy

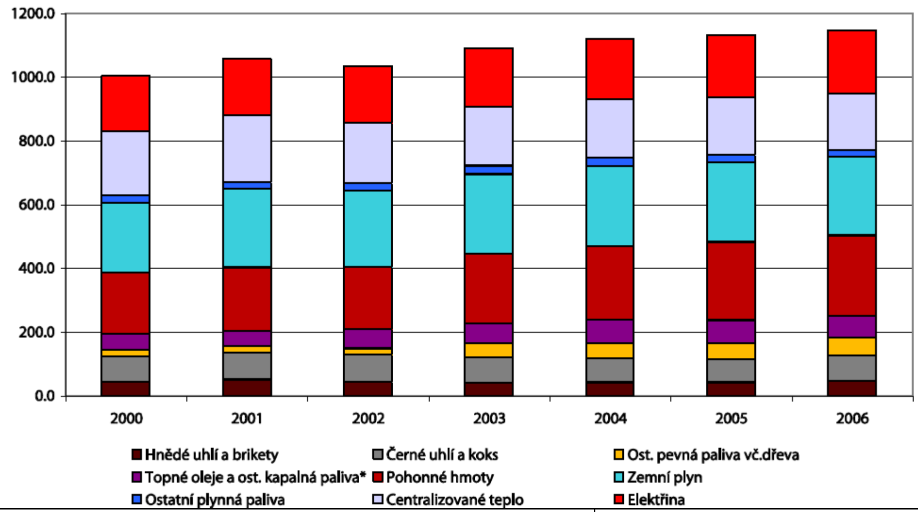
Ostatní paliva (vč. dřeva)	Other fuels (including wood)
Elektřina (saldo dovoz–vývoz)	Electricity (import-export balance)
Ropa plus ropné produkty	Petroleum plus petroleum products

Figure B.I.10: Energy demand of the Czech Republic's economy [MJ/CZK]



The structure of the final energy consumption, categorised by required fuels, is shown in the chart below.

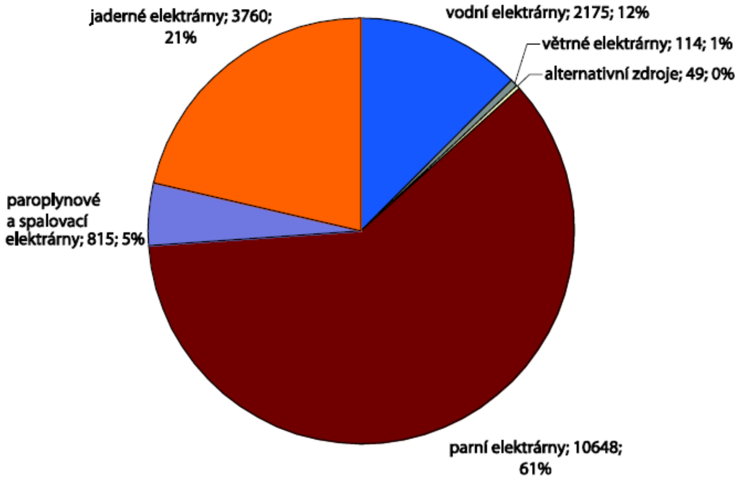
Figure B.I.11: End energy consumption by fuel type [PJ]



Hnědé uhlí a brikety	Brown coal and briquettes
Topné oleje a ostat. kapalná paliva	Heating oil and other liquid fuels
Ostatní plynná paliva	Other gaseous fuels
Černé uhlí a koks	Black coal and coke
Pohonné hmoty	Propellants
Centralizované teplo	Centralised heat
Ost. pevná paliva vč. dřeva	Other solid fuels including wood
Zemní plyn	Natural gas
Elektřina	Electricity

Speaking of electricity, the total installed capacity in the Czech Republic was 17561 MW_e at the end of 2007; its structure is shown in the chart below.

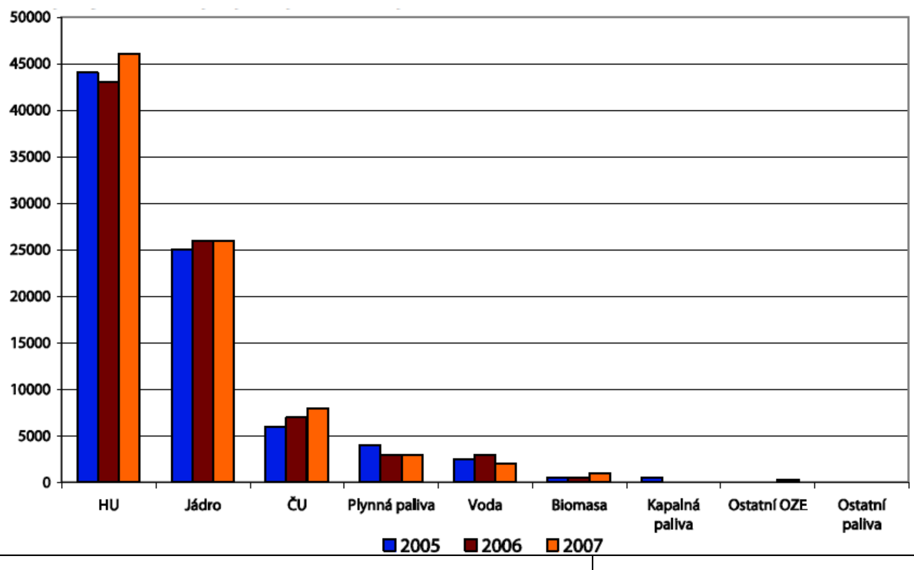
Figure B.I.12: Structure of installed capacities of the Czech Republic's power generation network, 2007 [MW, %]



Jaderné elektrárny	Nuclear power plants
Vodní elektrárny	Hydroelectric plants
Větrné elektrárny	Wind turbines
Alternativní zdroje	Alternative resources
Parní elektrárny	Steam power plants
Paroplynové a spalovací elektrárny	Steam-and-gas and incinerator power plants

Electricity generation has increased since 2000, with a decisive share of coal and a growing share of nuclear electricity; see the chart below.

Figure B.I.13: Trend of power generation structure, 2005-2007 [GWh]



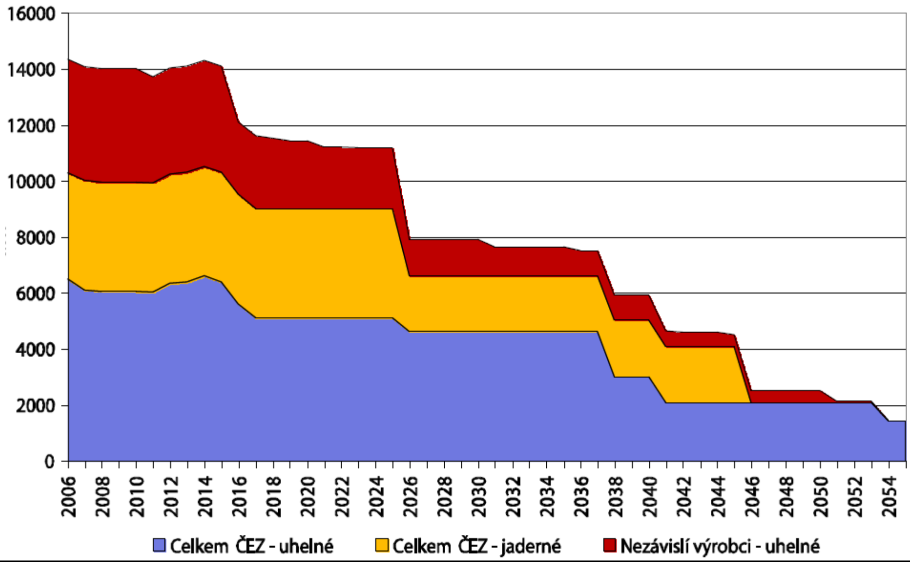
HU	Brown coal
Jádro	Nuclear
ČU	Black coal
Plynná paliva	Gaseous fuels
Voda	Water
Biomasa	Biomass
Kapalná paliva	Liquid fuels

Ostatní OZE	Other renewable energy resources
Ostatní paliva	Other fuels

At present, the CR's electricity generating sector is stabilised and self-sufficient, but cardinally dependent on two domestic sources: coal and nuclear fuel. That is a positive fact. On the other hand, the two main domestic sources are not without problems. Within the EU, coal is designated as only a marginally acceptable source, and the change in the issuance of emissions permits after 2012 (their partial sale instead of allocation) will very probably make brown coal much more expensive. Nuclear energy is admittedly exploited for energy purposes in 15 out of the EU's 27 member states, but debates of its future are still ongoing in some EU countries. That creates an air of major uncertainty among investors, who are postponing their decisions concerning the development of additional sources, and the electricity generating sector of those countries is about to become very vulnerable. In almost the whole of the EU, over 50% of the installed electricity-generating nuclear sources were built more than twenty years ago; 50% of coal power plants are older than 30 years and another 20% more than 20 years. The Czech Republic scored an advantage in this respect by commissioning two modern nuclear units at the Temelín Power Plant at the start of this decade and the clear intention to continue developing nuclear energy supported by public opinion.

In the case of the Czech Republic, we illustrate the same on the development of the total installed electricity-generating capacity (see chart below) in the next forty years if no additional sources are built; the chart does not reflect the possible extension of the useful life of both the nuclear power plants to up to 60 years, but the obsolescence of the sources is evident nonetheless.

Figure B.I.14: Czech Republic's power generation system: trend of installed capacity if additional sources are not built [MW]

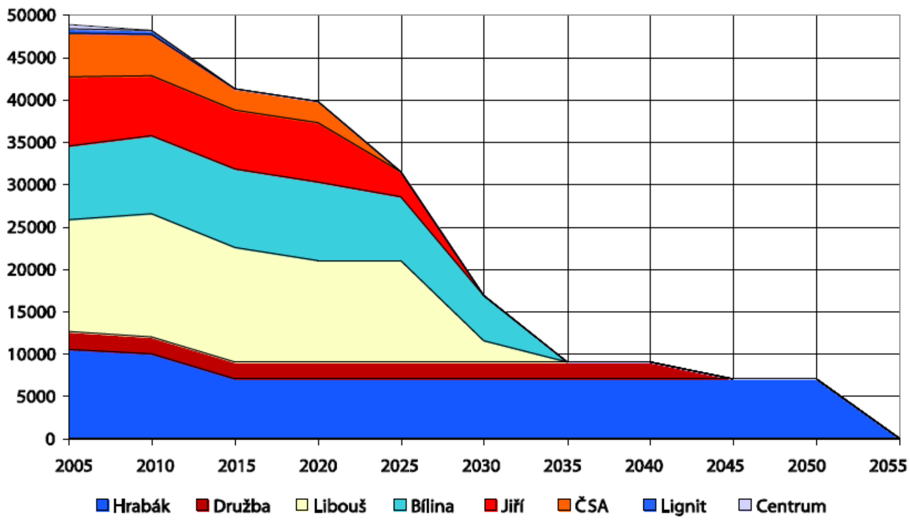


Celkem ČEZ – uhelné	ČEZ total - coal
Celkem ČEZ – jaderné	ČEZ total - nuclear
Nezávislí výrobci – uhelné	Independent producers - coal

Among conventional energy fuel sources, the Czech Republic has substantial reserves of hard and brown coal available, which make it the 10th to 15th country in the world in the quantity of the reserves. In all the assumed cases, however, the full future exploitation of the existing and potential reserves depends on a combination of several significant factors. First of all, it is the trend in demand and supply: the factors have very different effects for hard and brown coal or uranium; there are also environmental and landscape factors. The sources of oil and gas in the CR are negligible in relation to the current consumption. Renewable sources of energy, which have been gaining attention recently, are discussed in a separate chapter.

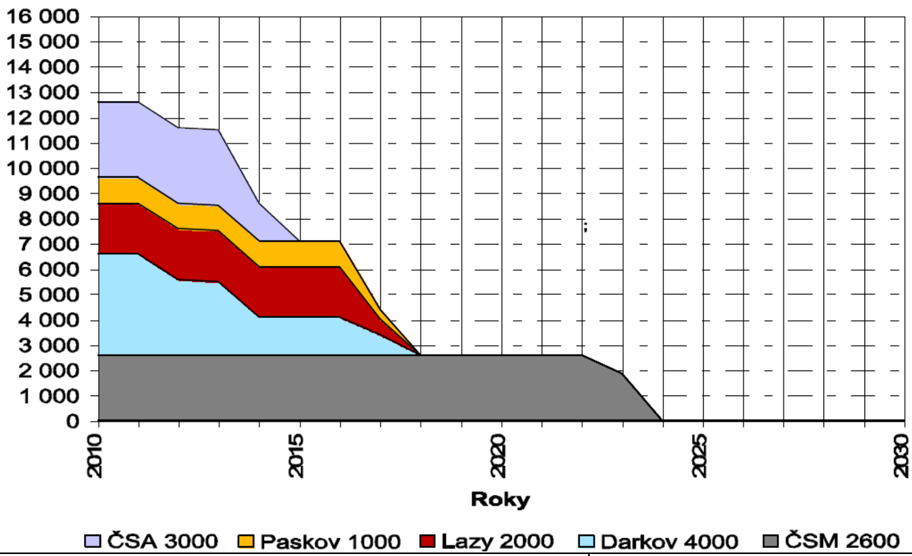
In spite of the relatively abundant geological reserves and economic reserves of brown coal, its exploitable reserves in the CR are small and the lifetime of the mines is between 14 and 50 years. This makes it possible to renovate only a part of the progressively ageing electricity and heat generating plants if this fuel base is to be continued. The chief obstacle to increasing the availability of brown coal in the medium term is the blockage of brown coal reserves by territorial environmental limits; the long-term obstacles are the impossibility to exploit the brown coal reserves in so called back-up sites (Bylany, Zahořany, and others). In the ČSA Mine alone, nearly 750 million tonnes of high-quality brown coal is locked beyond the extraction limits; it could be exploited in the long term well into the next century. In Bílina Mine, the territorial environmental limits block approximately 120 million tonnes of brown coal, which would extend the lifetime of the mine by approximately 15 years. The lifetime of the brown coal reserves is evident from the chart below.

Figure B.I.15: Brown coal and lignite reserve lifetime by the mines [thousands of tonnes]



The exploitable hard coal reserves will only last until 2030 at the latest. The chart below shows the prospects for hard coal mining at the existing exploitable reserves; in this case, the mining will end in 2024. If the exploitable reserves were expanded by approximately 80 million tonnes (OKD plans to dig deeper than 1,000 m within existing mines), the extraction would be extended until 2030 at the maximum annual exploitation.

Figure B.I.16: Prospective hard coal extraction [thousands of tonnes]



Roky	Year

The Czech Republic is among the 10 to 15 countries in the world that have natural uranium deposits available, and its extraction is currently still in progress at the Rožná I mine in Dolní Rožínka. The mine belongs to GEAM, a subsidiary of the state enterprise DIAMO; it has exploiting the central segment of the vast seam at Rožná since 1958. The marginal segments of the seam are progressively being remedied after historic extraction. The uranium mining balance for the CR also lists the Stráž seam managed by the DIAMO state enterprise at Stráž pod Ralskem. The seam is unexploited; some natural uranium is gained during remediation and shutdown works. The geological reserves of uranium are given in the table below.

Table B.I.: Geological reserves of natural uranium in the Czech Republic [t of metal]

Ložisko		Bilanční prozkoumané		Bilanční vyhledané		Bilanční
využívané	nevyužívané	volné	vázané	volné	vázané	celkem
ROŽNÁ		564,2		78,5		642,7
celkem využívaná		**564,2**		**78,5**		**642,7**
	OSEČNÁ	1112,7		19 357		20 469,7
nevyužívaná celkem		**1112,7**		**19 357**		**20 469,7**

Ložisko	Deposit
využívané	exploited
nevyužívané	unexploited
Bilanční prozkoumané	economic explored
volné	free
vázané	bound
Bilanční vyhledané	economic detected
volné	free
vázané	bound
Bilanční	Economic
celkem	total
celkem využívaná	total exploited
nevyužívaná celkem	total unexploited

It follows from the reserve analysis that the CR has a significant potential for uranium mining (mining renewal). The exploitable uranium reserves category only lists small quantities at the Rožná seam. Let us assume that they will be subject to further revision (increase) in the future. Other seams also have a potential for increases in all categories of reserves. The natural resources balance lists 6 unexploited seams. They are Hamr pod Ralskem, Stráž pod Ralskem, Břevniště pod Ralskem, Osečná-Kotel, Brzkov, and Jasenice - Pucov. There are also some other promising seams at Hvězdov, Mečichov, Holičky, and elsewhere. If nuclear energy registers a significant growth domestically and abroad, and given the current trend in commodity prices (including uranium) on the world markets, the Czech Republic's uranium reserves will become a realistic strategic commodity at least from the economic point of view. Nonetheless, it is worth highlighting that the execution of the project to build additional nuclear power plants is not conditioned on any extension (or renewal) of extraction in the CR, and the existing positive experience with procuring uranium on global markets for the existing nuclear units affirms the opportunity to acquire the fuel in this way.

Both the consumption of primary energy sources and the final energy consumption have been growing moderately in the recent years in agreement with the economic growth; the structure of the two indicators has been stable. The overall energy intensity of the CR's economy is above the European average, but these differences have to be viewed in the context of the lower price level in all the economies that underwent a crucial economic transformation after 1989. The CR's situation in electricity and heat supplies (at 50% share of centralised heat production) is stable in the long term on the one hand; on the other hand, it is a still lingering consequence of the socialist structure of the national economy focused primarily on metallurgy and heavy engineering, which was grounded in a seriously oversized, yet highly reliable installed capacity of coal-powered steam power plants and heating plants as well as the reliable operation of the Dukovany Nuclear Power Plant and later at Temelín. These have been appropriately accompanied by the controllable capacity of heating plants and the peak capacity in run-of-river and pumped-storage hydraulic power plants. The stability is still achieved thanks to a well-chosen fuel mix, based on the utilisation of domestic primary energy sources. With a few exceptions, these reliable sources, which have nonetheless become obsolete by now, were built 30 to 40 years ago, hence their parameters and efficiency rates correspond to that period.

At present, however, the CR's energy sector is at a major crossroads. The overall import energy intensity is admittedly acceptable in light of the EU standards, but the CR as a country is entirely dependent on imports of oil and gas - two raw materials crucial for the future; that is a major strategic limitation, although from the viewpoint of the country's contemporary energy sector, domestic power generation is virtually independent of oil and gas, with heat generation only partially dependent on natural gas. However, the reserves of coal, the crucial energy source at the moment, may be depleted in a few decades, and it is evident that brown and hard power coal extraction is going to decrease in the medium term; energy companies are facing a decision on how to substitute for these sources. The adoption of such decisions is being delayed and currently subject to needless restrictions based on a priori limitations (such as exclusion of debate on nuclear energy based on political papers). A primary current risk is associated with centralised heat supplies.

The chief problem of the Czech Republic's energy sector will be the replacement of the significant share of domestic coal with a fuel mix that is acceptable with regard to safety and economically affordable. This “fuel reform” is linked to the decreased coal production after 2015 and the lack of domestic coal after 2030. Electricity and heat producers should respond to the situation in time. The Government should promote improvement of pan-European transit systems for electricity, gas and oil as a technical preconditions both for establishing a competitive market and for safe and stable energy supplies. Given the uncertainty of oil and gas deliveries from the East, due attention has to be paid to maximising the exploitation of domestic sources and sources that can be stored in sufficient quantities in the long term. In this respect, gas and oil storage facilities and an assessment of the potentials for renewable sources of energy and nuclear energy play an important role. The Independent Energy Committee agreed on basic recommendations concerning the long-term securing of energy for the CR. These recommendations include support to innovation and latest technologies and the corresponding degree of education and qualification in the industry. These recommendations ought to be taken into consideration when formulating the country's energy policy.

The conclusions and recommendations of the Independent Energy Committee for the Government of the CR, considering economic, social and environmental contexts, are summarised in the following basic points:

The energy policy incorporates aspects arising from the economic, social and environmental contexts of the future development of Czech society. The primary areas are as follows:

- increasing emphasis on responsible behaviour of citizens - manufacturers, entrepreneurs and consumers (final consumption, its amount and form, affects energy flows, thus the negative burden on the population),
- consistent environmental protection against industrial and transport burdens,
- ensuring economic utilisation of both renewable and non-renewable energy sources,
- energy savings, rational waste management including recycling,
- progressive reduction of energy intensity in transportation.

The long-term development of the energy sector, which is already seriously dependent on importation of energy inputs (which dependence is going to grow further), is connected with long-term security of energy supplies. The long-term energy policy therefore has to consider the strategy of the world-wide development of the energy sector, the security of the country of origin of the energy sources and reliability of transport routes, including the generation of strategic stock of energy commodities and their management.

These principles give rise to the following recommendations by the Independent Energy Committee for the Government's further steps:

- The Government should actively support every measure that will lead to intensification of competition on energy markets. It shall follow this policy chiefly in the context of progressive establishment of a common energy market in the EU.
- The Government is advised to allow and facilitate the commencement of assessment processes on production of all energy types.
- The importance of brown coal is going to decrease in the long term; it will be a more expensive fuel but still an important energy source.
- The Government should consider processes leading to energy savings a priority and an exceptionally important component of a long-term energy strategy. It is therefore advised to pay increased attention, more funds than it has and systemic support to the area.

- Nuclear energy is one of the alternatives of electricity generation and an important part of the energy mix.
- The Government should regard renewable sources as an undisputable component of the future energy fuel mix. The Government is advised to consider support to heat generation from RSE, but review this support (as well as the existing support to electricity generation from RSE) periodically with an emphasis on minimising market distortions. Moreover, it is advised to support research and development of relevant technologies and substantially enhance information campaigns that support a more intense use of RSE.
- The Government should conduct a proactive climate protection policy on both the national and international scenes.
- The Government should employ the electricity transit network to improve the CR's position on the energy market.
- The Government is advised to revise the CR and EU's energy and associated legislation in order to prevent priority treatment of component energy projects to the detriment of more important energy needs of the society, especially stability of the industry, including energy transmission.
- The Government should actively cooperate with partners in the EU and NATO on building additional oil and natural gas transport routes to the CR.
- Within the EU, the Government should strive to promote a realistic and truly effective support to production of energy from RSE and evaluation of the emission permit trading system.
- The Committee recommends that a permanent authority deals with long-term trends, especially in research into new technologies and concepts in the energy sector and continuous monitoring of the country's energy situation in the context of the European and global energy sector. It advises the Government to support the planned establishment of an Institute for Applied Sciences, a joint workplace of the Academy of Sciences of the CR and CTU Prague, where that authority should operate.

It follows from the above information that the project is in line with the conclusions and recommendations of the Independent Energy Committee, represents one of the assumed alternatives of electricity generation and an important part of the energy mix together with savings.

Additional information concerning other facts regarding the different sources of energy is also drawn from the report of the Independent Energy Committee. This information is combined with other sources of information and is given in the relevant subchapters below.

B.I.5.2.2.3. Non-renewable electrical energy sources

Non-renewable electrical energy sources are dependent on reserves and supplies of fossil fuels. The Report of the Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee) deals with their potential in the Czech Republic (see the separate subchapter above for more details on the Report and the potential of fossil fuels in the CR).

The total share of non-renewable sources in the total installed capacity of the CR's power generating network is approximately 66% (2007 data). Out of that, steam power plants make up approximately 61%; steam-gas and combustion power plants, approximately 5%. The dependence on imported fossil sources and the anticipated overall reduction in coal mining in the Czech Republic (with regard to its reserves and territorial limits) is restrictive for non-renewable sources, so their share in both the installed capacity and the production is going to decrease.

Fossil fuel power plants

At present, the coal reserves within the territorial environmental limits only suffice for the continued operation of the completely refurbished Prunéřov II and Tušimice II power plants and a new coal power plant at Ledvice, which is a substitute for the existing outdated power plant.

The modern new units are built with a higher efficiency (up to 58% when using the steam-gas cycle). The existing old units work with an efficiency up to approximately 33%. Even if the thermal efficiency potentially increases, however, it is advisable to make a more efficient use of the coal reserves beyond the territorial environmental limits instead of combustion.

Gas power plants are commonly built for peak output, although they can also work in the base load. However, they are more commonly utilised in economies where gas is easily available without having to transport it over vast distances. Building a system of units with the necessary capacity would however cause a strong dependence of the Czech energy sector on importation of foreign sources. This would not be in line with the National Energy Policy, one of the goals of which is to reduce dependence.

Similar conclusions apply to the oil alternative as to the gas alternative. The share of oil power plants (power plants using liquid fuels) in the total electricity generation is currently negligible; an increase would result in deeper dependence on imports. It has to be added that the Czech Republic currently does not have capacities for reprocessing raw oil into a form suitable for combustion. An oil project would therefore include a new petrochemical plant, including a transport pipeline supplying the new energy source.

B.I.5.2.2.4. Renewable electrical energy sources

The Report of the Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee) deals with the potential for renewable sources of electricity in the Czech Republic (see above for more details on the Report).

Renewable sources of energy could generate 49.8 TWh of electricity in the Czech Republic; this is the available potential, the exploitation of which will augment progressively over several decades. The assumption is that the rapid technological development of devices for utilisation of renewable sources, particularly photovoltaic materials and energy storage systems, continues at its current pace and that the exploitation of deep geothermal energy is mastered by means of HDR (hot dry rocks) applications. In the shorter term, until 2030, the available potential for generating electricity from renewable sources in the Czech Republic is 22.5 TWh (see table below). Most of that amount can be obtained thanks to biomass in biogas stations and pure and combined combustion in heating plants. A more significant increase following the current trends can be expected in photovoltaic and wind power plants. New geothermal sources should be put into operation too.

Table B.I.: Expected development in power generation from renewable sources until 2030 [TWh]

TWh	2005	2010	2015	2020	2025	2030
vodní	2,38	2,14	2,24	2,43	2,46	2,48
větrná	0,02	0,60	1,75	2,55	4,02	4,71
biomasa	0,73	1,62	3,31	5,26	6,80	8,02
geotermální	0,00	0,00	0,13	0,48	0,94	1,58
sluneční	0,00	0,15	0,50	0,98	2,73	5,67
celkem	**3,13**	**4,51**	**7,93**	**11,70**	**16,94**	**22,46**

TWh	TWh
vodní	hydro
větrná	wind
biomasa	biomass
geotermální	geothermal
sluneční	solar
celkem	total

Both the absolute production and the relative share of renewable sources of energy in the energy mix will increase. Along with savings, renewable sources are a means for reducing the consumption of non-renewable sources and energy supply security. Nevertheless, their total exploitable potential is relatively low, and on their own, they cannot cover the demand for electricity or substitute for the capacity of coal power plants nearing the end of their lifetime.

The individual renewable sources and their potential are characterised as follows:

Hydroelectric power plants

At present, hydroelectric power plants have the highest share in electricity generation from renewable sources. Virtually all the rivers in the Czech Republic have their sources here and all the water leaves the territory, meaning that a significant portion of the hydraulic energy is dispersed across the territory in small watercourses. Compared to other European countries, the Czech Republic is ranked among countries poor in hydraulic energy with approximately 350 kWh/ha. It is a fact that the greater part of the country's potential is already being exploited. At present, hydropower plants in the Czech Republic are producing 2.11 TWh of electricity annually (converted to the average hydraulic year) with 2176 MW of installed capacity. In future, executions will be in points where the hydrotechnical conditions are substantially worse than for power plants built in the past.

The hydraulic energy potential of the Czech Republic therefore does not permit the construction of a hydraulic energy source or a system of sources making it possible to replace the capacity of the coal power plants in the base and medium loads near the end of their useful life. Small hydropower plants, the development of which can be expected in the coming years, albeit in a limited extent, have to be regarded as auxiliary sources only. Even installing additional larger-scale hydraulic facilities would not make it possible to achieve the necessary capacity due to the head potential of the major watercourses, which has been mostly exploited already.

Wind power plants

The utilisation of wind power plants connected to the electrical grid is a relatively recent affair. Wind energy has been developed with extraordinary intensity in Europe and the rest of the world in the last twenty years, unlike in the CR. The Czech Republic had 66 wind power plants with a total installed nominal capacity of 65.5 MW at the end of 2006; there were approximately 100 wind power plants with a total capacity for 114 MW at the end of 2007. The amount of electricity generated in wind power plants was 125 GWh in 2007: a massive annual increase by 153%.

A sufficient wind potential is a crucial prerequisite for the functioning of a wind energy sector. The average wind speed at 100 m above ground should be at least 6 m/s. Like other EU countries, the Czech Republic has numerous legislative restrictions and technical requirements on construction of wind power plants. The background studies that arrived at the available wind energy potential calculated with these significant limitations.

Based on the wind energy development in the CR so far and using development data and trends abroad, it is assumed that only machines with a capacity of 2.3 and 6 MW will be installed in the coming years. Overall, the assumed average utilisation is over 2,200 hours after 2020. The existing installations of 600 kW and less would virtually not be operated. Continued installation of turbines with a capacity of approximately 6 MW and more is assumed for 2020-2030. New sites for installation of wind power plants are not assumed in 2030-2050; instead, the production should increase by replacing the 2 and 3 MW units with more powerful ones.

The estimated realisable available wind energy potential is expressed by the number of 1,260 wind turbines, the total installed capacity of 2750 MW, and the corresponding factual annual production of approximately 6000 GWh.

The total installed wind power plant capacity in 2020 can be assumed to be approximately 1160 MW. Such a capacity will require a certain capacity back-up in order to secure the stability of the power generating network. Under present-day criteria, capacity in excess of 500 MW requires a capacity back-up of 20% of the capacity in excess of 500 MW.

Biomass power plants

The utilisation of biomass is one of the most promising renewable energy sources. The total technical potential of biomass in the CR in the long term is nearly 700 PJ of energy. However, this amount would mean the exploitation of all the arable land, production of the other farmland, the annual increment of the dendromass, and utilisation of all the recycled materials. The above value is therefore only regarded as a theoretical value used for purposes of comparison.

The resulting value of the available potential derives from the sum of agricultural, forest and remaining biomass, and is 276 PJ. This biomass can be used for generating heat and electricity and biofuel production.

Geothermal power plants

The utilisation of geothermal energy seems to be a very promising option for obtaining energy. In the Czech Republic, however, only the hot dry rock (HDR) system can be considered in addition to thermal pumps. The bedrock (Bohemian Basement) contains reservoirs of heat comprising only impenetrable rock at a sufficiently high temperature depending on its depth. Two bores several kilometres deep are made in a selected rock environment; their ends are several hundred metres apart, and a permeable collector has to be created in between them by fragmenting the rock. Water is introduced via the absorption bore and penetrates the created system of fissures, which acts like a heat exchanger. The water returns to the surface via the pump bore in the form of hot water or steam, bringing energy with it. The HDR technology with deep bores cannot be utilised in spa areas with thermal springs by reason of protecting them. Even there, however, the heat contained in the springs can be exploited for heating.

Photovoltaic power plants

One of the options for utilising solar radiation is to generate electricity in photovoltaic systems or solar-thermal facilities. The average annual utilisation of photovoltaic power plants, comprising clusters of photovoltaic panels covering an area, is approximately 935 hours in the Czech Republic. Both the efficiency and power output of photovoltaic power plants are relatively low, but will increase with the continuing technological advances. The total production in 2030 is assumed to be approximately 5.7 TWh. Photovoltaic power plants require a certain capacity back-up in order to secure the stability of the power generating network when out of operation (nightfall, cloudy weather).

Other renewable sources

The Czech Republic does not have any other renewable sources of electricity available at significant quantities (such as tidal power plants).

B.I.5.2.2.5. Nuclear power

At present, nuclear power is based on the exploitation of nuclear fission (nuclear fusion is not being exploited for electricity generation, and is being researched). This is a physical reaction, in contrast to combustion of fossil fuels, which is a chemical reaction. Nuclear fission provides approximately 3,000,000 times more energy per unit of mass than combustion.

Present-day nuclear power plants use largely enriched uranium as their fuel; this is natural uranium in which the content of the isotope ^{235}U is increased from the approximate original 0.7% to 2-5%. The economically extractable reserves of uranium in the world (excluding phosphate ores) are over 12 million tonnes (including estimated and unsurveyed reserves); see the table below[1]. Phosphate ores contain an addition of more than 20 million tonnes.

[1] The table is quoted in the Report of the Independent Expert Committee for Assessment of the Czech Republic's Energy Needs (Pačes Committee) and is based on the OECD paper Uranium 2005: Resources, Production and Demand in Perspective. Different data on uranium reserves exist. The OECD paper Uranium 2007: Resources, Production and Demand ("Red Book") shows 21.5 million tonnes, including 5.5 million tonnes of verified reserves (at extraction costs up to USD 130/kg).

Table B.I.: Global reserves of uranium and thorium

	Ověřené zásoby až do 130 $/kgU	Odhadované zásoby až do 130 $/kgU	Neprozkoumané zásoby až do 130 $/kgU	Celkové zásoby až do 130 $/kgU	Odhadované zásoby Th 2005	Těžba uranu rok 2005	Kumulativní těžba do 2005	Spotřeba 2005	Zásoby/Spotřeba	Spotřeba/Těžba
	10^3 t U	10^3 t U	10^3 t U	10^3 t U	10^3 t Th	10^3 t U/rok	10^3 t U	10^3 t U	rok	%
Afrika	671	235	1 138	2 044	479	6,9	393	0,2	9 291	3 %
Severní Amerika	709	111	2 110	2 930	609	12,7	756	19,7	149	155 %
Jižní Amerika	167	132	902	1 201	1 306	0,1	5	0,6	2 001	545 %
Asie	737	407	2 288	3 433	403	7,7	100	14,1	244	183 %
Ruská federace	132	41	545	717	6	3,4	39	3,6	199	105 %
Evropa	115	75	542	732	1 290	1,4	862	26,0	28	1891 %
Střední východ	31	50	11	91	7	0,0	0	0,0	NA	NA
Oceánie	747	396		1 143	6	9,5	132	0,0	NA	0 %
Celkem – svět	3308	1446	7536	12 290	4106	41,7	2287	64,2	192	154 %
ČR	2	19	115	136		0,4	100	0,7	209	170 %

Afrika	Africa
Severní Amerika	North America
Jižní Amerika	South America
Asie	Asia
Ruská federace	Russian Federation
Evropa	Europe
Střední východ	Middle East
Oceánie	Oceania
Celkem – svět	World total
ČR	Czech Republic
Ověřené zásoby až do 130 $/kgU	Explored reserves up to $130/kgU
Odhadované zásoby až do 130 $/kgU	Estimated reserves up to $130/kgU
Neprozkoumané zásoby až do 130 $/kgU	Unexplored reserves up to $130/kgU
Celkové zásoby až do 130 $/kgU	Total reserves up to $130/kgU
Odhadované zásoby Th 2005	Estimated reserves of Th, 2005
Těžba uranu za rok 2005	Uranium extraction in 2005
Kumulativní těžba do 2005	Accumulated extraction before 2005
Spotřeba 2005	Consumption in 2005
Zásoby/Spotřeba	Reserves/Consumption
Spotřeba/Těžba	Consumption/Extraction

The useful life of the reserves at the current consumption (approximately 64,000 t/yr) is approximately 200 years; it will decrease proportionately to the development of the nuclear power sector. The extraction of phosphate ores may cover a substantially increased utilisation of nuclear power. When fast reactors are used, the efficiency of the reserves is two orders of magnitude higher.

The risk associated with purchasing uranium is lower than for fossil fuels. Uranium mining is not concentrated in a single region, so local fluctuations can be covered from other regions. Concerning the actual production (fabrication) of fuel, there are diversified suppliers. Fuel for globally operated reactor types is manufactured in several different plants. Reactors commonly use fuels from multiple manufacturers at the same time. Thus, there are alternative suppliers of nuclear fuel, who are capable of supplying fuel in the event of a long-term dropout of a primary manufacturer. There is no risk of a lack of the uranium raw material for the expected period of operation of the new nuclear power plant.

Any risk of a temporary lack of fuel in the power plant will be eliminated by an appropriate fuel cycle strategy making use of a necessary amount of stock. The amounts of fuel necessary for the operation of a nuclear power plant, negligible in comparison with conventional power plants, make it possible to generate a stock of fuel for several years directly inside the power plant or stored at the suppliers. A normal out-of-basin coal power plant has a capacity for coal storage for 1.5 to 3 months of operation. In contrast to that, for example, the fuel storehouse capacity in the Dukovany Nuclear Power Plant makes it possible to amass fuel for up to 3.5 years of operation.

It is therefore evident that a nuclear power plant is superlatively reliable in terms of availability of fuel for the production.

Nuclear power plants

The Czech Republic has two nuclear power plants: Temelín Nuclear Power Plant (TNPP) and Dukovany Nuclear Power Plant (DNPP). The current total installed capacity of both power plants (2009) is approximately 3920 MW_e.

Dukovany PP was commissioned between 1985 and 1987. It is fitted with four VVER 440 units of the V213 type. Three of the units provide an electrical output of approximately 460 MW_e each; one provides about 500 MW_e. The total installed capacity of the power plant at the time of writing this documentation is thus approximately 1880 MW_e. In light of the upgrading in progress, the capacity will increase to 2000 MW_e (4x500 MW_e) by 2012.

Temelín PP was commissioned between 2000 and 2002. It is fitted with two VVER 1000 units of the V320 type. At present, the units are operated at an electricity output of approximately 1020 MW_e. The total installed capacity of the power plant is thus approximately 2040 MW_e. The power plant site was originally developed for 4 units, but a decision was made after 1989 to only complete two units.

Nuclear power in the world

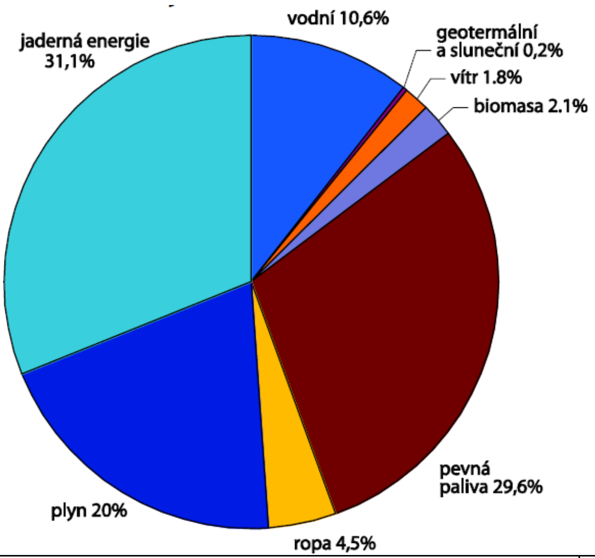
Globally, 439 power plant units are operated with a total installed capacity of approximately 372 GW_e; 5 units are out of operation for prolonged periods of times, and 34 units are under construction (2007 data)[1].

The European Union has 146 nuclear reactors in operation with a total installed capacity of approximately 132 GW_e; another 4 reactors to provide approximately 5.2 GW_e are under construction (2007 data).

The share of sources in power generation in the European Union is evident from the chart below (2004 data).

[1] The 2007 data come from the Pačes Committee report. As of January 2009, 436 units were operated with a total installed capacity of approximately 372 GW_e and 43 units were under construction globally.

Figure B.I.17: Share of sources in power generation in the EU, 2004



Jaderná energie	Nuclear energy
Vodní	Hydro
Geotermální a sluneční	Geothermal and solar
Vítr	Wind
Biomasa	Biomass
Pevná paliva	Solid fuels
Ropa	Petroleum
Plyn	Gas

B.I.5.2.2.6. Potential for savings

The Report of the Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (so called Pačes Committee) deals with the issue of future energy savings in the Czech Republic (see above for more details on the Report).

In order to quantify the energy savings potential, a model of the final energy consumption (FEC) in the national economy was made. The model is determined by a sum of forecasts of final energy consumptions in the sectors of the national economy (households, tertiary sphere, industry, transport, and others - chiefly agriculture and construction). The overall FEC forecast is determined by the sum of the FEC by its form; the forms considered are as follows:

- solid (hard and brown coal, lignite, biomass and other products made by processing them, such as coke, pellets and pressed coal),
- liquid (e.g., petrol, diesel, light fuel oil and other petroleum derivatives),
- gaseous (natural gas and other products of the gasification process as part of energy transformation, such as biogas from organic waste),
- centralised heat (all thermal energy generated used for heating, domestic hot water making and industrial processes, made within centralised heating systems in the network of heating plants),
- electrical energy (all electrical energy delivered to legitimate end customers within the respective regional distribution network).

The forecast is made for five-year periods until 2050; it is based on statistically proven FEC values for 2005. The following scenarios are considered for the comparison of the possible FEC trend:

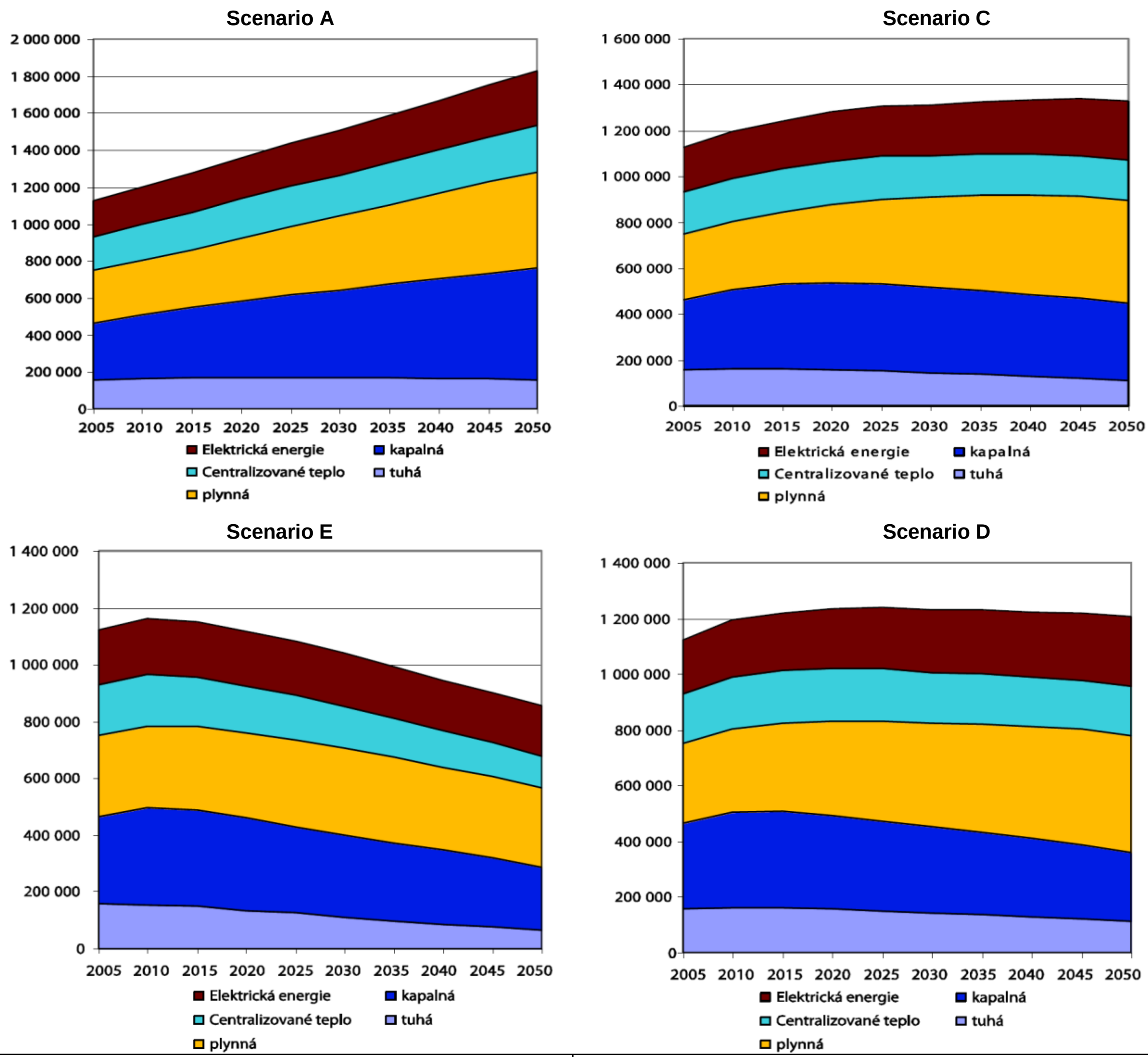
Scenario A - High (BAU, Business as Usual): The scenario assumes the currently very intense activity of the EU in the sphere of increasing energy efficiency and utilisation of RSE to drop. The CR's activity will be negative. During the forecast period, implementation of measures to increase energy efficiency is expected to be generated spontaneously by the market based on profitability, without external stimuli. The trend in energy prices in scenario A follows the majority forecasts anticipating energy prices to return near the situation around 2000. Even though the scenario does not rule out upward and downward oscillations, it is based on an assumption of relatively low energy prices with a long-term trend of moderate growth until 2050. In this scenario, the total FEC will increase by approximately 63%.

Scenario C - Medium (progressive intensification): The scenario was compiled with the aim to quantify a scenario with a progressive intensification of measures to increase energy efficiency for exploitation of available energy sources. In addition to the below development parameters, it assumes the establishment of an external context that considers the following facts. The EU will continue to be very active in the sphere of supporting increasing energy efficiency and utilisation of RSE. The Czech Republic will be active insofar as to meet its most pressing EU Member obligations in the sphere of implementing relevant EC directives concerning increasing energy efficiency and savings measures. The trend in energy prices in scenario C tends more to forecasts anticipating a certain return of energy prices back from the current level, but not as low as the situation in 2000. Even though the scenario does not rule out upward and downward oscillations, it is based on an assumption of relatively higher energy prices between scenarios A and E with a long-term trend of incessant growth until 2050. This scenario assumes a progressive improvement in the energy efficiency of employed technologies and a slow growth in the total FEC. The total FEC should stabilise after 2035 at approximately 1,330 PJ, an increase by some 18%.

Scenario E - Low (energy efficient): The scenario was compiled with the aim to quantify a scenario with a high efficiency of exploitation of energy sources and natural resources in general. In addition to the below development parameters, it assumes the systemic establishment of a motivating environment for all involved entities in all spheres of societal development and use of best available technologies. The EU will continue to be very active in the sphere of supporting increasing energy efficiency and increased utilisation of RSE. The CR's attitude in this sphere will change substantially. The CR will increase its own activity in supporting increasing energy efficiency while supporting industries and business in sectors of the national economy with a direct connection to increasing energy efficiency. The CR will understand this support as an opportunity to improve its economic competitiveness within the EU and on other global markets. The trend in energy prices in scenario E does not follow the majority forecasts anticipating energy prices to return near the situation around 2000. Even though the scenario does not rule out upward and downward oscillations, it is based on an assumption of relatively high energy prices with a long-term trend of incessant growth until 2050. After the implementation of best technologies and an effective motivating strategy, which will lead to maximum application of available energy-efficient technologies, the FEC will decrease by approximately one quarter by 2050.

Scenario D - Low Medium: The outline of scenarios for development of the energy intensity of the Czech Republic's economy also included a scenario D, so called Low Medium, characterised by an FEC trend as in scenario C for all sectors except transportation. In the transportation sector, traffic intensities and consumption of the various forms of FEC are assumed according to the so called innovation scenario, which is employed in scenario E. Under this scenario, which takes into consideration a slow improvement in the energy efficiency of technologies used outside the transportation sector and a substantial improvement in the energy efficiency in the transportation sector in accordance with so called innovation scenario, the total FEC will increase slightly from 1,122,858 TJ in 2005 to 1,205,510 TJ in 2050.

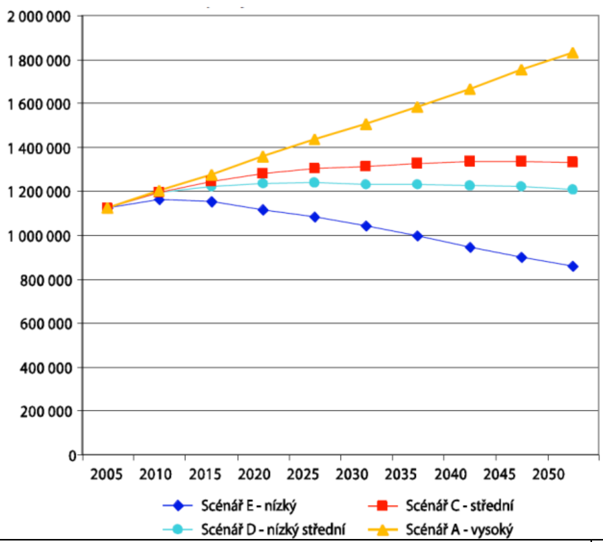
Figure B.I.18: Trend in total FEC by all sectors of the national economy [TJ/year] in each scenario



Elekrická energie	Electrical energy
Centralizované teplo	Centralised heat
Plynná	Gaseous
Kapalná	Liquid
Tuhá	Solid

The quantification of the potential for energy savings is based on the difference in FEC in scenario A compared to scenario C and scenario E. A comparison of the scenarios is made in the figure below.

Figure B.I.19: Comparison of FEC trend scenarios until 2050 [TJ/year]



Scénář E – nízký	Scenario E - low
Scénář D – nízký střední	Scenario D - low-to-medium
Scénář C – střední	Scenario E - medium
Scénář A – vysoký	Scenario E - high

It is evident that mostly solid and liquid fuels will be conserved in all the scenarios (except the reference scenario A). In contrast to that, the consumption of gaseous fuels will increase. The current trends in centralised heat are retained in most of the scenarios, or only insignificant changes occur. The trend in electricity is mostly a growing one (except scenario E).

Moreover, the Report of the Independent Energy Committee deals with the energy intensity of the Czech economy in all the scenarios; scenario A assumes an average annual decrease in the energy intensity by approximately 1.4%; it is approximately 2.1% for scenario C, approximately 3% for scenario E, and approximately 2.3% for scenario D. The overall energy intensity of the Czech Republic's economy will thus continue to converge towards lower values, meaning higher efficiency of energy utilisation. However, the absolute consumption of electricity will not decrease; it is expected to grow.

The potential for savings is therefore a welcome contribution to the energy security (along with renewable sources of energy). On its own, however, it is not capable of covering the demand for energies.

B.I.5.2.2.7. Hydrogen production in the nuclear power plant

The hydrogen production technology is an opportunity to make use of the power output of electricity generating facilities in times of reduced demand for electricity. However, this option is not very appropriate for the purposes of controlling the energy network; it is rather inappropriate.

The energy required for the chemical reactions in hydrogen production can be delivered in the form of heat or electricity or in other ways (photobiological or photochemical processes or high-energy radioactive radiation). The temperature required for the chemical reactions in hydrogen production (steam reforming of natural gas, gasification of coal or biomass, thermal decomposition of water, etc.) is at least 750°C and more. However, operating temperatures in pressurised water reactors only achieve less than half that value. It is therefore evident that a direct utilisation of the thermal energy without non-economical additional heating is not possible. Photobiological or photochemical processes do not provide sufficient output; moreover, the application of high-energy ionising radiation raises the issue of separating the hydrogen from radioactive particles and gases.

The only available option is therefore the use of electricity. The process can be operated wherever there is enough electricity and water available. Water electrolysis, i.e., decomposition of water using electricity, is a fully developed commercial technology with relative little demand for space. In contrast to the hydrocarbon methods, it releases no harmful emissions. It can bring another specific advantage within a nuclear power plant: the absence of high-temperature and high-pressure processes, which would raise requirements on the operating safety.

However, electrolysis cannot be practically utilised to control the power output (i.e., simplified continuous maintenance of an equilibrium between the source output and the power network load). Electrolytic hydrogen production requires continuous supply of electricity, and given the assumed capacity (in the order of MW), the oscillation in the supplies due to the automated control feature would mean an unacceptable degree of strain on the output components of the electrolyser. The portion of the power plant output required for the continuous control is therefore not suitable for hydrogen production.

There is only one option: utilisation of part of the electricity generated. That would guarantee a continuous supply of electricity for the electrolysis, but on the other hand, the supplies to the grid would be reduced by that amount. The electricity generated is then available virtually anywhere, so the electrolyser need not be situated inside the power plant.

B.I.5.2.2.8.Greenhouse gas emissions

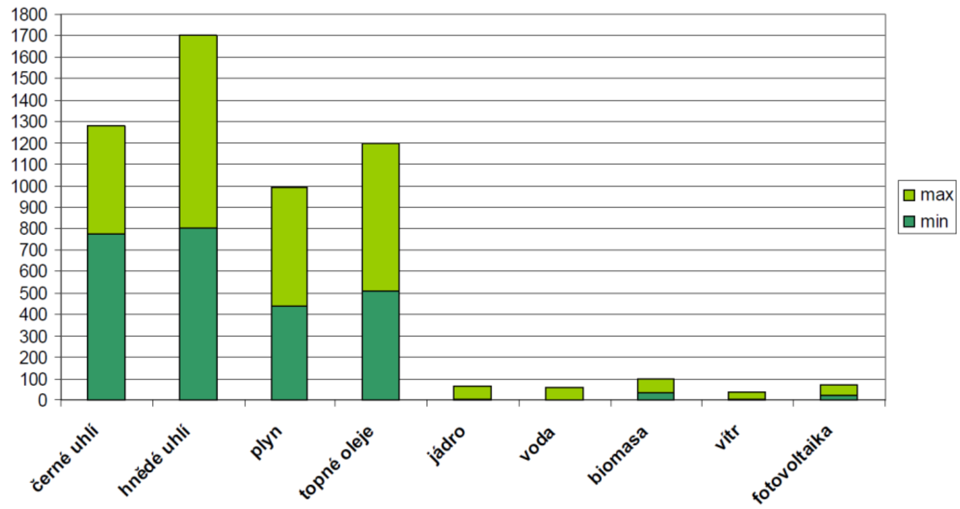
The so called life-cycle assessment / life-cycle analysis (LCA) is employed in assessing the environmental impacts of various energy sources. The LCA rules are defined in the ISO 14000 series of standards, focusing on environmental management. The LCA identifies the amount of energy spent and production of greenhouse gases in each stage of the production. It comprises fuel extraction, processing and transportation, power plant construction, decommissioning, waste management and any other applicable related activities. The total amount of gases produced is compared to the total amount of energy generated. Multiple types of greenhouse gases (typically CO_2, CH_4 and N_2O) are produced throughout the production chain. Since each of them has a different impact on the greenhouse effect and different lifetime, the gases are converted using a coefficient (GWP, global warming potential), reflecting the different absorption capacity of the gases. For example, the GWP values are $CO_2 = 1$, $CH_4 = 21$, $N_2O = 310$. The sum of the converted emissions is called the aggregated (total) emission and quoted as CO_2 equivalent (CO_2-e).

Information on emissions differs in different sources. Therefore, our presentation employs the diploma thesis of Bc. Martin Kiš, West Bohemian University of Plzen, Electrotechnical Faculty, Department of Technologies and Measurement, 2009, on Carbon dioxide balance in constructing a new nuclear power plant compared to other types of sources. The paper summarises and compares emissions from various types of sources based on information published in various papers. The range of emission information identified is summarised in the table and figure below.

Table B.I.: Comparison of emissions from all sources [g CO_2-e/kWh]

	min.	Peak
hard coal	774	1,280
brown coal	800	1,700
gas	440	991
heating oils	512	1,200
nuclear	2.8	65
water	1	60
biomass*	35	99
wind	8	40
solar	21	73
* Biomass does not include emissions generated by combustion, as the released amount of CO_2 has been consumed by the biomass growth. The balance is thus zero.		

Figure B.I.20: Comparison of emissions from all sources [g CO_2-e/kWh]



Černé uhlí	Black coal
Hnědé uhlí	Brown coal
Plyn	Gas
Ropné oleje	Petroleum oils
Jádro	Nuclear
Voda	Water
Biomasa	Biomass
Vítr	Wind
Fotovoltaika	Photovoltaic

It is evident that the greenhouse gas emissions from nuclear power plants are comparable to those from renewable sources. It is chiefly due to the fact that no greenhouse gases are produced directly when generating the electricity; another reason is the great amount of energy generated. All the emissions produced are indirect. Their amounts are thus determined by the share of low-emission sources in the energy mix. A greater share of nuclear power plants and renewable sources therefore also leads to reducing those indirect emissions.

B.I.5.2.2.9. Comparison of radioactive emissions from conventional and nuclear power plants

Emissions of radionuclides into the air from conventional and nuclear power plants differ greatly both qualitatively and quantitatively. The crucial aspect for assessing the impacts on human health is not the total quantity of radionuclides from the assessed source, but especially the radiotoxicity of those radioactive elements that enter the body not only via inhaled air but also via contaminated food and water.

For Temelín Nuclear Power Plant, for instance, the theoretical committed effective dose from the annual admission from discharges by TPP units 1 and 2 into the air in 2008 was approximately 0.03 μSv in the most exposed person. Over 80% of that dose was due to discharges of the C-14 radionuclide, of which approximately 440 GBq were discharged. However, that radionuclide only constituted about 5% of the total activity of the discharges. In contrast, radioisotopes of noble gases such as Xe, Kr, Ar contribute a dominant share of the activity in the discharges (approximately 9 TBq) but only have a minor share in the irradiation of the population.

Natural gas commonly contains Rn-222, causing a specific activity of approximately 340 Bq/m^3. This radioactive gas and its daughter products enter the air during combustion, which causes an annual discharge of approximately 575 GBq from a 1000 MW_e gas power plant. The irradiation of persons exposed to the discharges from gas power plants is generally negligible, but comparable to the consequences of discharges into the air from a nuclear power plant. Given the stack height of 50 to 100 m in a 1000 MW_e gas power plant, the theoretical committed effective dose from the annual intake via emission inhalation is between approximately 0.01 and 0.06 μSv.

Coal contains U-238 and Th-232; the specific activities of these radionuclides are typically between 10 and 25 Bq/kg. Ash and fly ash then contains these radionuclides at specific activities of 200 to 400 Bq/kg. A 1000 MWe power plant emits approximately 0.27 GBq of U-238, 0.13 GBq of Th-228, 0.2 GBq of Ra-226, 57 GBq of Rn-222, 0.6 GBq of Pb-210, 1.3 GBq of Po-210, 0.5 GBq of K-40 into the air annually. These are all rather toxic radionuclides. The radiation consequences of the operation of coal power plants are not significant compared to the other adverse environmental impacts, but they may be substantially greater than the consequences of the operation of a nuclear power plant (depending on many factors, such as boiler capacity, coal quality, ash separator efficiency, local weather conditions). Given the stack height of 50 to 100 m in a 1000 MW_e coal power plant, the theoretical committed effective dose from the annual intake mostly via emission inhalation, but also ingestion and external irradiation is between approximately 0.4 and 1 µSv.

B.I.5.2.3. Zero alternative

The zero alternative stands for not executing the project in any of its execution alternatives. The zero alternative is related to the project itself; i.e., the zero alternative is the non-execution of the new nuclear power source at the Temelín site including power output to the Kočín switchyard.

The consequences of the zero alternative would consist in the necessity to secure a substitute for the capacity of the electricity sources in the Czech Republic near the end of their useful life in a different way. The Temelín site has been historically equipped with space and infrastructures for four nuclear units; only two have been completed and operated. Not using that potential would mean having to build other sources of electricity.

This alternative is assumed as reference in elaborating this documentation; its impacts on the environment are described by the current state of the environment (more accurately, its development trends) in the affected area. However, impacts of the other sources that would secure a capacity substitute for the project go beyond the scope of this documentation and are only discussed in general.

B.I.6. Description of the project technical and technological design

B.I.6.1. Basic information

A basic technical and technological description of the assumed project design types is made in this chapter. The description is divided into a general part, defining the NNPP project with III+ generation PWR units, and a specific part, describing the technical design of the AES-2006 (traded as MIR-1200), AP1000, EPR and EU-APWR units.

These units are the capacity alternatives of the possible design; the first two are units of approximate 1200 MW_e capacity and the other two approximately 1700 MW_e.

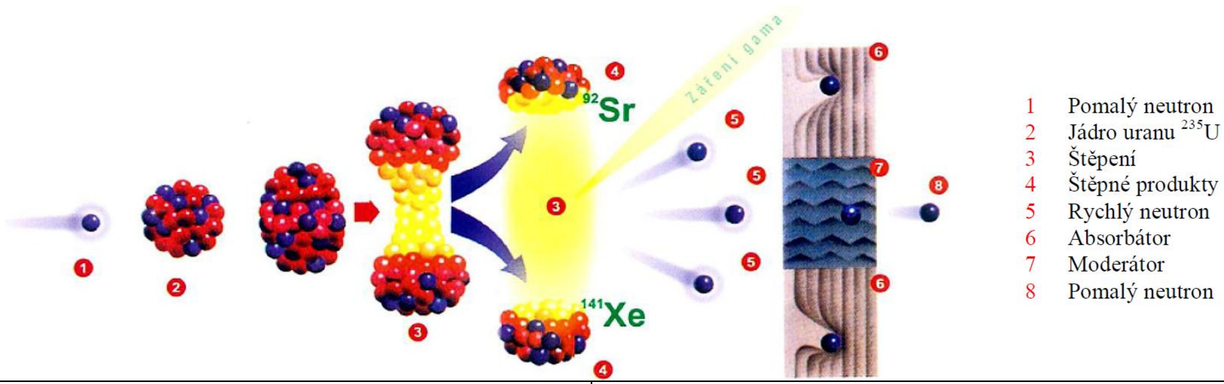
B.I.6.1.1. Physical principle of a nuclear power plant with a PWR reactor

The principle of electricity generation in a nuclear power plant agrees with the principle of any other thermal power plant. With some simplification, it can be described by the following chain:

- primary source of energy - fuel (coal, oil, gas, nuclear fuel, geothermal energy, etc.),
- use of fuel for generating thermal energy (coal boiler, burners, nuclear reactor, etc.),
- use of thermal energy for generating steam (boiler, steam generator),
- use of steam for generating kinetic energy (turbine),
- use of kinetic energy for generating electricity (turbo generator).

The primary element of a nuclear power plant is a nuclear reactor, in which a nuclear reaction takes place generating heat. Nuclear reactors operated at present exclusively employ nuclear fission reaction (the employment of the fusion reaction is being researched). The heat generated is then used to generate steam. The following figure shows the principle of the nuclear fission reaction.

Figure B.I.21: Schematic diagram of the fission reaction



Pomalý neutron	Slow neutron
Jádro uranu 235U	235U uranium nucleus
Štěpaní	Fission
Štěpné produkty	Fission products
Rychlý neutron	Fast neutron
Absorbátor	Absorber
Moderátor	Moderator
Pomalý neutron	Slow neutron

The principle of the reaction consists in splitting an atomic nucleus (typically uranium ^{235}U) with a decelerated (slow) neutron. This forces the nucleus to fall into two fragments and release part of the bond energy (exploited later on as heat) and additional neutrons. Those are capable of splitting other nuclei in turn, hence the name “chain reaction”. In the energy application, the chain reaction is controlled so that only one of the neutrons produced at a time is decelerated and provokes another fission reaction; the other neutrons are intercepted. In this case, the chain reaction continues; it neither grows larger nor diminishes. This condition is the normal operation of a nuclear reactor at a constant capacity.

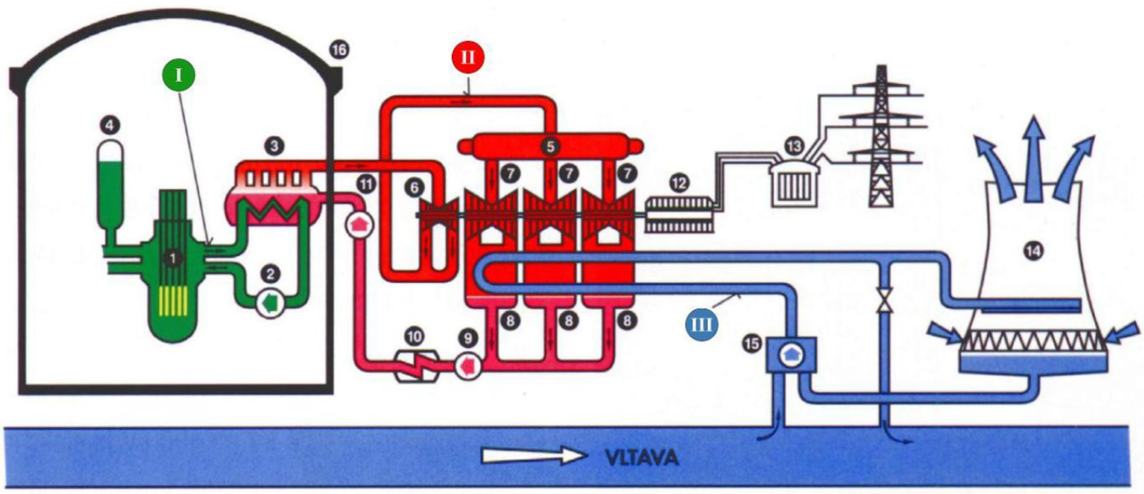
The substance used in the fission is called the *(nuclear) fuel*; the substance that slows down the neutrons is the *moderator*; the substance that intercepts the neutrons is the *absorber*; and the heat-carrying medium that takes heat out of the reactor is the *coolant*.

The reactor in the project is a PWR (Pressurised Water Reactor). This is a pressurised water reactor that uses uranium as the nuclear fuel (its concentration of the isotope ^{235}U has been artificially increased to no more than 5% of ^{235}U) in the form of tablets of uranium dioxide (UO_2) arranged in fuel rods. Both the moderator and coolant in this type of reactor is demineralised water (with additions of boracic acid and pH-adjusting substances), which is maintained under pressure, meaning it does not transform into steam and remains in the liquid state even at temperatures above 300°C. The coolant passes through the reactor, where it is heated, then enters the steam generator, where it delivers part of its thermal energy, then returns to the reactor. This circuit is called the *primary circuit*. The heat delivered by the primary circuit to the steam generator, generates steam. The steam under pressure enters the turbine, which it forces to rotate, then after it has spent its energy and condensed back into water, it is pumped back into the steam generator. This circuit is called the *secondary circuit*. The aftercooling and condensation of secondary circuit water makes use of the main *cooling circuit*, which passes through cooling towers and is replenished with treated raw water from a suitable source (the Vltava River for Temelín Power Plant). The rotary motion of the turbine is employed for actuating the electricity generator, which generates electricity, which is then evacuated into the power network.

The primary circuit devices are enclosed in a *protective envelope (containment)*, the purpose of which is both to prevent the release of radioactive substances into the environment (should the primary circuit be breached) and to protect the primary circuit devices from a potential external danger (such as a falling airplane).

The layout of a power plant with a PWR reactor is obvious from the following figure.

Figure B.I.22: Schematic of a power plant with a PWR unit



I – PRIMÁRNÍ OKRUH

1 Reaktor
2 Hlavní cirkulační čerpadlo
3 Parogenerátor
4 Kompenzátor objemu
16 Kontejnment

II – SEKUNDÁRNÍ OKRUH

5 Separátor - přihřívák
6 Vysokotlaký díl turbíny
7 Nízkotlaký díl turbíny
8 Kondenzátor
9 Kondenzátní čerpadlo
10 Regenerace
11 Napájecí čerpadlo
12 Turbogenerátor
13 Blokový transformátor

III – HLAVNÍ CHLADÍCÍ OKRUH

14 Chladící věž
15 Čerpací stanice

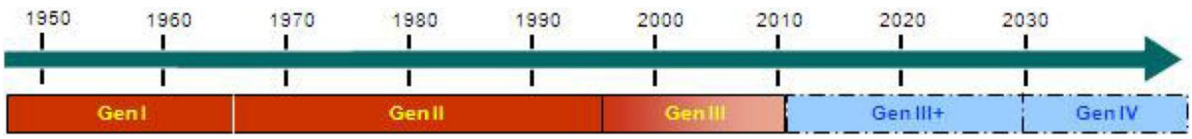
I – PRIMÁRNÍ OKRUH	I - PRIMARY CIRCUIT
1 Reaktor	1 Reactor
2 Hlavní cirkulační čerpadlo	2 Reactor circulation pump
3 Parogenerátor	3 Steam generator
6 Kompensátor objemu	6 Pressuriser
16 Kontejnment	16 Containment
II – SEKUNDÁRNÍ OKRUH	II - SECONDARY CIRCUIT
5 Separátor přihřívák	5 Separator heat exchanger
6 Vysokotlaký díl turbíny	6 Turbine high pressure section
7 Nízkotlaký díl turbíny	7 Turbine low pressure section
8 Kondenzátor	8 Condenser
9 Kondenzátní čerpadlo	9 Condensate pump
10 Regenerace	10 Regeneration
11 Napájecí čerpadlo	11 Feed pump
12 Turbogenerátor	12 Turbo-generator
13 Blokový transformátor	13 Block transformer
III – HLAVNÍ CHLADICÍ OKRUH	III - MAIN COOLING CIRCUIT
14 Chladicí věž	14 Cooling tower
15 Čerpací stanice	15 Pumping station

B.I.6.1.2. Evolution of nuclear reactors

In the nuclear energy sector, units of the 3rd or 3+ generation are the current level of BAT (Best Available Techniques). These are the latest nuclear power plant designs, which have better process, safety and economic properties compared to previous generations.

The figure below shows the progressive evolution in the nuclear power sector.

Figure B.I.23: Nuclear reactor generations



The construction of the 1st generation of nuclear power reactors, which put nuclear energy to a peaceful use for the first time, commenced in the 1950s. Following the first power plants, built more for demonstration purposes, the first competitive commercial units were put into operation; their construction continued into the 1960s and 70s. Those power plants are largely out of operation today. The last reactors of this generation still in operation are the two Magnox reactors in Wylfa Power Plant in the UK; they are cooled with CO_2 and have graphite for the moderator.

Construction of 2nd generation power plants commenced in the 1970s. The safety of these technologies was one order of magnitude above that of the 1st generation. At present, these power plants have a significant share in the market supplies, and their technical condition permits extending their operation beyond the original design expectancy. More than one half of them are light-water PWR reactors (including the VVER units built in Czechoslovakia and still in operation in the CR and Slovakia). In addition to these PWR types, the energy industry also makes a wide use of boiling-water reactors (BWR). The Canadian concept CANDU of heavy-water reactors (PHWR) has been employed less widely. British AGR-type and Russian RBMK-type reactors are 2nd generation graphite reactors.

Third generation power plants currently make use of the best available technologies derived from the well-tested 2nd generation types. The chief differences from the 2nd generation are:

- standardised design, reducing the time required for licensing each power plant, required investment costs and construction time,
- simplified as well as more robust design, permitting easier operator work and increasing operating reserves,
- greater availability (90% and more), higher net efficiency (up to 37%), and longer useful life (at least 60 years),
- lower risk of accident featuring serious damage to the active zone (much below 10^{-5}/year),
- higher resistance to external influences,
- potential for better spending of fuel (fuel utilisation increase up to 70 GWd/tU) and reduced amount of waste generated,
- extended period of fuel inside the active zone by using spending absorbers (up to 24 months).

The 3+ generation is a smooth follow-up on the 3rd one. These reactors have improved operating economics. PWR reactors in the 3+ generation include the EPR units at Olkiluoto in Finland and Flamanville in France, as well as the new Russian AES-2006 reactor (traded as MIR-1200) in the VVER evolution series, the Japan-made EU-APWR, and the reactors in the AP1000 units made by Westinghouse. The reactor (more accurately, the power plant) in this project belong to this generation.

According to the current state of development, the first power plants of the next, 4th generation are expected to start operation around 2030. They also include so called fast reactors, which should make a more efficient use of uranium. The high-temperature reactor will allow additional applications of nuclear energy, such as production of hydrogen as an alternative fuel for motor vehicles.

B.I.6.1.3. Statistical data on nuclear power plants in the world

At present, over 430 nuclear energy reactors are in operation around the world with a total installed capacity of approximately 370GW_e; another several dozens of nuclear power plant units are in various stages of development. The construction of the following units has commenced in recent years:

Table B.I.: Overview of units whose construction started after 2004

2004	Tomari 3	PWR, 866 MW_e, Japan
	Kalpakkam	FBR, 470 MW_e, India
2005	Olkiluoto 3	PWR, 1600 MW_e, Finland
	Lingao 3	PWR, 1000 MW_e, China
	Chasnupp 2	PWR, 300 MW_e, Pakistan
2006	Qinsahn II-3	PWR, 610 MW_e, China
	Lingao 4	PWR, 1000 MW_e, China
	Shin Kori 1	PWR, 960 MW_e, South Korea
	Beloyarsk 4	FBR, 750 MW_e, Russia
2007	Qinsahn II-4	PWR, 610 MW_e, China
	Shin Kori 2	PWR, 960 MW_e, South Korea
	Hongyanhe 1	PWR, 1000 MW_e, China
	Shimane 3	BWR, 1325 MW_e, Japan
	Shin Wolsong 1	PWR, 960 MW_e, South Korea
	Flamanville 3	PWR, 1600 MW_e, France
2008	Ningde 1	PWR, 1000 MW_e, China
	Hongyanhe 2	PWR, 1000 MW_e, China
	Novovoronezh II-1	PWR (VVER), 1085 MW_e, Russia
	Shin Wolsong 2	PWR, 960 MW_e, South Korea
	Leningrad II-1	PWR (VVER), 1085 MW_e, Russia
	Shin Kori 3	PWR, 960 MW_e, South Korea
	Ningde 2	PWR, 1000 MW_e, China
	Fuqing 1	PWR, 1000 MW_e, China
	Yangjiang 1	PWR, 1000 MW_e, China
	Fangjiashan 1	PWR, 1000 MW_e, China
2009	Hongyanhe 3	PWR, 1000 MW_e, China
	Hongyanhe 4	PWR, 1000 MW_e, China
	Sanmen 1	PWR, 1117 MW_e, China
	Sanmen 2	PWR, 1117 MW_e, China
	Yangjiang 2	PWR, 1000 MW_e, China
	Fuqing 2	PWR, 1000 MW_e, China
	Novovoronezh II-2	PWR (VVER), 1085 MW_e, Russia
	Fangjiashan 2	PWR, 1000 MW_e, China
	Shin Kori 4	PWR, 1400 MW_e, South Korea
	Haiyang 1	PWR, 1117 MW_e, China
	Taishan 1	PWR, 1700 MW_e, China
	Mochovce 3	PWR (VVER), 405 MW_e, Slovakia
	Mochovce 4	PWR (VVER), 405 MW_e, Slovakia
2010	Ningde 3	PWR, 1000 MW_e, China

It is evident that the overwhelming part of the newly built reactors is PWR.

The table below shows an overview of reactors in the 3rd or 3+ generation that are currently commercially available.

Table B.I.: Overview of reactors of the IIIrd or IIIrd+ generation with an output over 1000 MW_e

Type	Name	Manufacturer/Supplier/Reference
BWR	ABWR	GE Energy http://www.gepower.com/prod_serv/products/nuclear_energy/en/new_reactors/abwr.htm
BWR	ESBWR	GE Energy http://www.gepower.com/prod_serv/products/nuclear_energy/en/new_reactors/esbwr.htm
BWR	KERENA	AREVA http://www.areva.com/EN/global-offer-420/kerena-a-midpower-boiling-water-reactor.html
PWR	EU-APWR	Mitsubishi http://www.mhi.co.jp/en/nuclear/euapwr/
PWR	EPR	AREVA http://www.areva.com/EN/global-offer-419/epr-reactor-one-of-the-most-powerful-in-the-world.html
PWR	OPR1000	Korea Hydro and Nuclear Power Company http://www.opr1000.com/
PWR	APR1400	Korea Hydro and Nuclear Power Company http://www.apr1400.com/
PWR	AP1000	Westinghouse http://www.ap1000.westinghousenuclear.com/
PWR	ATMEA1	AREVA - Mitsubishi http://www.areva.com/EN/global-offer-418/atmea1-a-pressurised-water-reactor-for-all-networks.html
PWR	AES-2006 (traded as MIR-1200)	Atomstrojexport http://www.rosatom.ru/en/about/projects/npp_2006/
PHWR	ACR-1000	AECL http://www.aecl.ca/Reactors/ACR-1000.htm

B.I.6.1.4. Safety arrangement information

B.I.6.1.4.1. Legislative requirements

Pursuant to Act no. 18/1997 Coll. on peaceful use of nuclear energy and ionising radiation (Atomic Act) and on change and additions of some related laws, as amended, the State Office for Nuclear Safety (SONS) performs supervision over nuclear safety in the Czech Republic.

The Office also licenses nuclear power plants in respect of nuclear safety. The multi-tier licensing process is defined by the Atomic Act and the associated SONS Decrees, which are continuously harmonised with European Union and International Atomic Energy Agency (IAEA) regulations. An overview of the regulations is made in the Chapter List of documents applied (page 24 in this documentation).

The first step in the licensing process taken by SONS is an assessment of a so called assignment safety report, submitted by the applicant when locating the nuclear facility. The report primarily describes and documents the suitability of the location and the assumed chief characteristics of the new nuclear power plant (capacity, type, radioactive discharges, etc.)[1]. The next step is an assessment of a so called preliminary safety report, elaborated by the applicant after the selection of the supplier of the nuclear facility, which fully describes the project and documents the satisfaction of safety requirements on its project documentation. The elaboration of this report and the resulting SONS permit is one of the preconditions for the issuance of a construction permit. The last major step before commencement of commissioning the nuclear power plant is a SONS permit, based on an assessment of a so called pre-operational safety report, containing a review of quality assurance during the project execution and changes in the design compared to the description made in the preliminary safety report, thus the actual state of the completed facility ready for operation.

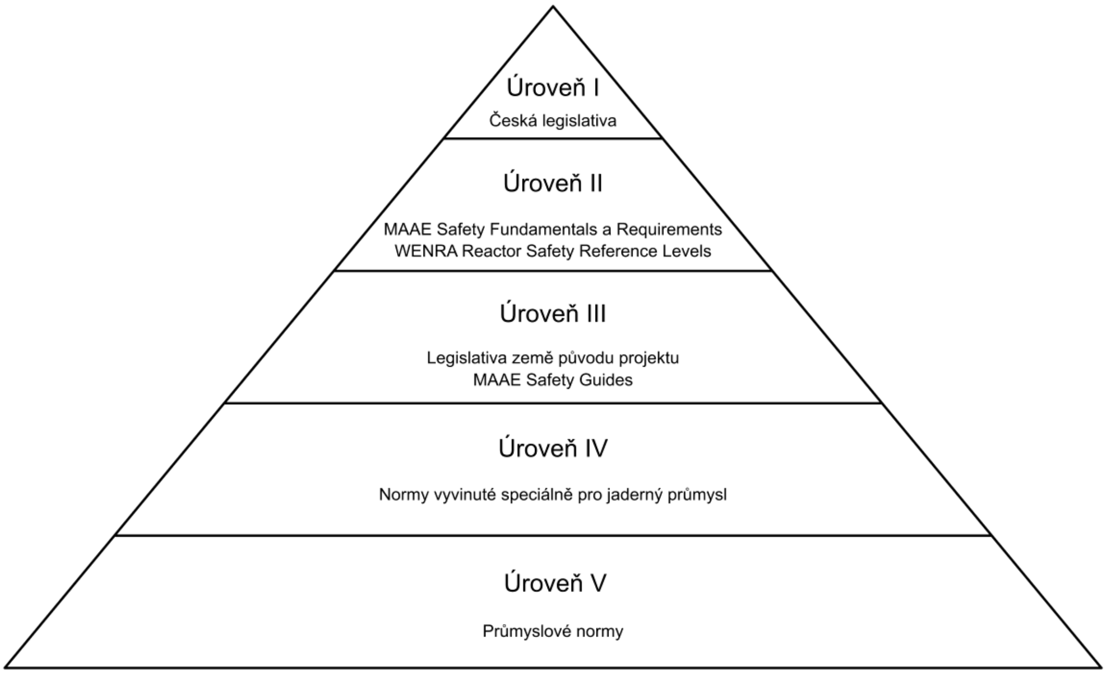
The project will comply with at least the basic International Atomic Energy Agency (IAEA) requirements - the Safety Fundamentals and Safety Requirements. Moreover, consideration of the Western European Nuclear Regulators' Association (WENRA, of which SONS is a member) documents and those of the EUR (requirements of European electricity producers on light-water reactors, including pressurised water reactors) is required.

During the selective bidding, therefore, the supplier offers its standardised design, licensed or being licensed in the country of origin of the nuclear segment design or in a European Union country, and the design only lists modifications required by the Czech legislation or necessary for integration of the design into the Temelín site.

Below is a hierarchy of requirements on NNPP; the importance of meeting the requirements increases from the fifth level to the first level requirements.

[1] In this respect, the Temelín site has been approved as suitable for the location of the existing power plant.

Figure B.I.24: Hierarchy of regulations and standards



Úroveň I	Level I
Česká legislativa	Czech legislation
Úroveň II	Level II
MAAE Safety Fundamentals and Requirements	IAEA Safety Fundamentals and Requirements
WENRA Reactor Safety Reference Level	WENRA Reactor Safety Reference Level
Úroveň III	Level III
Legislativa země původu projektu	Nuclear Safety Regulation used during licensing proces of the Reference Plant and Standard Design
MAAE Safety Guides	IAEA Safety Guides
Úroveň IV	Level IV
Normy vyvinuté speciálně pro jadrný průmysl	Nuclear oriented codes and standards
Úroveň V	Level V
Průmyslové normy	Conventional codes and standards

Level I - Czech legislation: The first, most important level contains requirements resulting from the wording of acts of law, decrees (especially State Office for Nuclear Safety decrees) and government regulations relating to activities associated with utilisation of nuclear energy, notably the construction of a nuclear power plant, commissioning of a nuclear power plant, and operation of a nuclear power plant.

Level II - IAEA Safety Fundamentals and Requirements and WENRA Reactor Safety Reference Levels: The second level contains the internationally recognised documents defining the basic requirements on nuclear safety.

The IAEA Safety Fundamentals define the fundamental safety objective of using nuclear energy as protection of the population and the environment from the harmful effects of ionising radiation, and elaborate on it into detailed goals, concepts and principles of nuclear safety.

The IAEA Safety Requirements directly derive from the above document and elaborates the above general goals into specific requirements on the design of a nuclear power plant, its structures, systems and components, and regulations important for assuring nuclear safety.

The WENRA Reactor Safety Reference Levels contain the basic requirements on a power plant design (in the scope of IAEA Safety Requirements) which are the joint expression of WENRA.

Further development in the safety requirements of these organisations will be followed.

Level III - Nuclear Safety Regulation used during licensing proces of the Reference Plant and StandardDesign: The third level of requirement mostly comprises requirements arising from the legislation in the country of origin of the design, or that of an EU country in which the design is licensed (or being licensed) and recommendations made in the IAEA Safety Guides.

These requirements related to nuclear safety will be applied in compliance with documents containing requirements on the structures, systems and components of nuclear facilities (Level IV) as a consistent system of regulations and standards on which the above required licensing process is based.

Level IV - Nuclear oriented codes and standards: The fourth level of requirements comprises a complete set of nuclear regulations and standards (national, applied in the licensing process in the country of origin of the reactor technology or an EU country and appropriately accompanied with recognised international standards for the nuclear sector, such as ISO, EN, IEC, IEEC, if required) that follow up on Level III.

Level V - Conventional codes and standards: The fifth level comprises a complete set of general regulations and standards designed in compliance with the above higher levels, which will mostly be applied in the project design for the associated systems in the secondary segment.

B.I.6.1.4.2. Safety characteristics of 3+ generation reactors

In contrast to the 2nd generation of reactors, where selection beyond design basis accidents could only be handled with the advancement in safety requirements and science and technology, the 3rd generation assesses the necessity to handle selected beyond design basis accidents (in terms of stricter requirements on the new nuclear units) during the design stage.

That is why 3rd or 3+ generation designs feature new design systems specially intended for handling selected beyond design basis accidents, such as low-pressure meltdown of the active zone, accidents without reactor shutdown, complete power supply failure, etc. Different requirements are generally made on these systems than on systems for handling design basis accidents due to the very low probability of occurrence of this type of accidents.

The introduction of the new systems for handling beyond design basis accidents or improvement to existing systems (such as increased pressure resistance of the protective envelope, use of double containment for better protection from containment bypass and external impacts) has reduced the probability of active zone meltdown and major leaks by at least one order of magnitude compared to the 2nd generation of reactors. The potential consequences of design basis accidents on the environment have also been reduced.

B.I.6.1.4.3. Defence in depth safety principle

The power plant design will apply the defence in depth principle, which is based on the use of multiple physical barriers preventing the leak of radioactive substances and ensuring integrity of these barriers with a system of complementary technical and organisational measures. Both the measures and the physical barriers are arranged in a way that if a lower-level measure or barrier fails, a higher-level measure and barrier is applied in the next step. The application of the defence in depth principle ensures that even in multiple equipment or operator failure at multiple levels of protection, the population and the environment will not be endangered. The defence in depth levels are as follows:

Level 1 consists in preventing deviations from normal operation and avoidance of malfunctions.

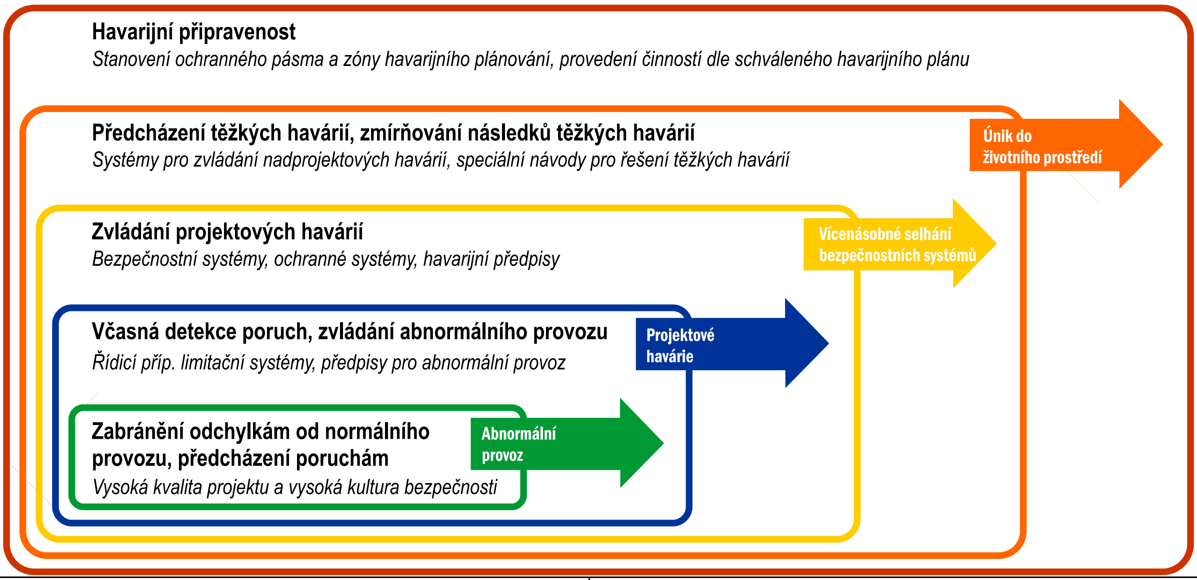
Level 2 is secured by timely detection of malfunctions and means for harnessing abnormal operation.

Level 3 comprises means for harnessing design basis accidents so that the transition of the facility to a safe condition is assured.

Level 4 is secured by means for preventing serious accidents and mitigation of their consequences if they do occur.

Level 5 comprises emergency plans and means for implementing them making it possible to take measures to mitigate the radiation consequences of major leaks of radioactive substances.

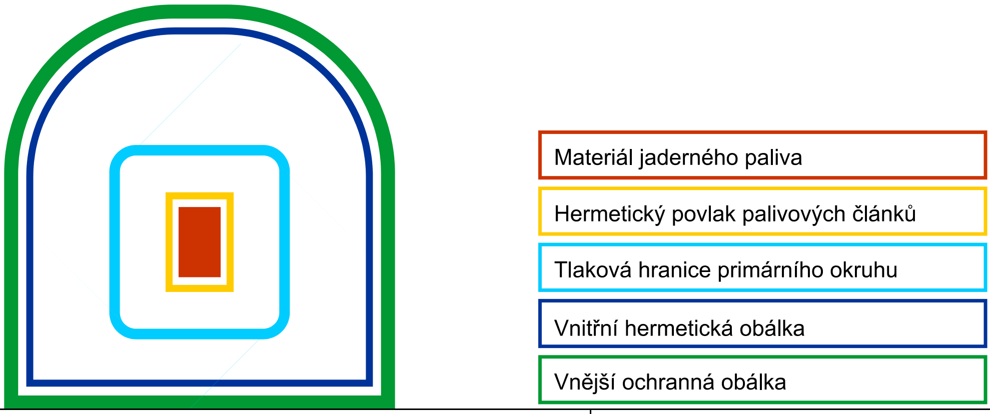
Figure B.I.25: Levels of defence in depth



Havarijní připravenost	**Emergency preparedness**
Stanovení ochranného pásma a zóny havarijního plánování, provedení činnosti dle schváleného havarijního plánu	Defining protection zone and emergency planning zone, taking actions according to approved emergency plan
Předcházení těžkých havarií, zmírňování následků těžkých havárií	**Preventing heavy accidents, alleviating consequences of heavy accidents**
Systémy pro zvládání nadprojektových havárií, speciální návody pro řešení těžkých havárií	Systems for coping with beyond design basic accidents, special guidelines for dealing with heavy accidents
Zvládání projektových havárií	**Coping with design basic accidents**
Bezpečnostní systémy, ochranní systémy, havarijní předpisy	Safety systems, protective systems, emergency regulations
Včasná detekce poruch, zvládání abnormálního provozu	**Early fault detection, coping with abnormal operation**
Řídící příp. limitační systémy, předpisy pro abnormální provoz	Control or limitation systems, abnormal operation regulations
Zabránění odchylkám of normálního provozu, předcházení poruchám	**Avoiding deviations from normal operation, fault prevention**
Vysoká kvalita projektu a vysoká kultura bezpečnosti	High design quality and high safety culture
Únik do životního prostředí	Escape into environment
Vícenásobné selhání bezpečnostního systému	Multiple safety system failure
Projektové havárie	Design basic accidents
Abnormální provoz	Abnormal operation

The physical barriers against leaks of radioactive substances are the nuclear fuel material and the hermetic coat of the fuel cells, the pressure boundary of the primary circuit and the protective envelope system (containment). These barriers will be designed so that the integrity of all the barriers during operating states is preserved. During emergencies, the integrity of the barriers will be preserved insofar as they can perform safety functions. During a serious accident, the integrity of at least a barrier, i.e., the protective envelope (containment) will be preserved.

Figure B.I.26: Physical barriers to leakage of radioactive substances



Materiál jaderného paliva	Nuclear fuel material
Hermetický povlak palivových článků	Hermetic fuel cell sheath
Tlaková hranice primárního okruhu	Primary circuit pressure boundary
Vnitřní hermetická obálka	Internal hermetic envelope
Vnější ochranná obálka	Containment

B.I.6.1.4.3.1. Qualified operators and reliable operation

A high safety culture is an indispensable component of defence in depth at the Temelín (as well as Dukovany) power plant. This principle, fully integrated in all the relevant procedures of ČEZ, ensures that all operations important to nuclear safety are performed in an organised fashion, with due care, and only by highly professional workers.

The workers performing operations with an immediate effect on nuclear safety are and will be selected based on the requirements on psychic and professional eligibility made in Decree no. 146/1997 Coll. The psychic eligibility comprises the successful passing of performance and personality-based psychological tests. The professional eligibility comprises relevant professional education and passing a training course approved by the State Office for Nuclear Safety. In accordance with the requirements of the above Decree, professional knowledge is reviewed by a state examination committee after the training is completed. The workers' knowledge and psychic eligibility will be periodically reviewed during their work in the power plant, and they will be subject to periodic retraining. Periodic reviews of the professional knowledge again takes place in the form of an examination before a state examination committee. Retraining of workers (shifts to different positions) takes place in accordance with training courses approved by the SONS, and the retraining includes a review of the employee's knowledge before a state examination committee.

An integral part of the training, qualification maintenance and retraining of workers will be training on a full-scale simulator, which accurately simulates the real operation of a power plant, including simulations of potential emergencies.

The safety culture in the CR's nuclear power plants is regularly reviewed by international missions of the OSART [1] (IAEA operating safety assessment team). Three missions had taken place at Temelín PP and four at Dukovany PP by 2010. The conclusions from all the missions stated a high level of safety culture in operating the CR's nuclear power plants. Further missions at both the power plants are scheduled for 2011 and 2012.

B.I.6.1.4.3.2. Basic safety features

The preservation of functionality of the barriers to leaks of radioactive substances will be secured by compliance with the following safety features:

[1] More information is available at http://www-ns.iaea.org/downloads/ni/s-reviews/osart/osart_brochure.pdf

- the reactor can be shut down and kept down under any circumstances,
- heat can be conducted away from the nuclear fuel for a sufficiently long time,
- radioactive substances can be held within the physical barriers.

Compliance with the basic safety features will be ensured by the implementation of complementary technical and organisational measures at the different levels of defence in depth.

The systems assuring the performance of the basic safety features will have multiple back-up (redundancy principle) in order to secure the reliability of their functioning, and the systems and their multiple divisions will employ maximum protection from failure by a common cause. Failure by a common cause, i.e., inactivation of multiple divisions or system for a common reason, will be reduced by using various technical designs of the divisions and systems (diversity principle), using spatial separation (physical separation principle), and by means of limited interconnection of the systems (functional isolation principle). These systems will also be provided with adequate self-reliance in terms of energy supplies (pressurised air, electricity, etc.) and operating media (water, air, etc.).

B.I.6.1.4.3.3. Safety assessment

The safety assessment will be performed in compliance with the requirements of the Czech Republic's legislation. Proof of the suitability of the site will be submitted in the assignment safety report; proof of the design safety will be submitted primarily in the preliminary safety report and then in the pre-operation safety report.

The assessment is carried out using both deterministic and probability safety assessment analysis. An uncertainty analysis and a sensitivity analysis is also carried out in both cases.

The deterministic analysis demonstrates the compliance with the safety features for a wide range of initiating events (including internal events and internal and external effects), thus the preservation of sufficient functionality of the physical barriers. The effect of the simultaneous inactivation of both the operating and back-up power supply will be assumed conservatively, and a simple malfunction will also be assumed.

The probability analysis will then prove the sufficiently low probability of injury to the active zone ($<10^{-5}$/year) and a major radioactive leak ($<10^{-6}$/year). At the same time, the balance of the safety measures for handling the different initiating events will be verified so that no dominant risk exists in the design.

The adequacy of the fire prevention system will be assessed using a fire risk analysis, and the probability analysis will also prove that the safety risks associated with a fire comply to the requirements on proving sufficiently low frequency of injury to the active zone ($<10^{-5}$/year) and major radioactive leaks ($<10^{-6}$/year). Structures unimportant to nuclear safety will be handled in compliance with the fire prevention legislation in force.

The pre-operation safety report will be updated during operation in accordance with experience gained during the power plant operation. It will also reflect any changes to the design arising from experience with analogous nuclear units abroad. Any changes and updates of the safety report will be approved by the State Office for Nuclear Safety.

B.I.6.1.4.4. Emergency planning

An emergency planning zone was defined in the 1990s in connection with the construction of NPP Temelín. Its purpose in compliance with Government Resolution no. 11/1999 Coll. is to ensure the timely and premeditated response to the potential occurrence of a nuclear accident. It is divided into an inner sector (5 km) and an outer sector (13 km). Notifications, warnings and urgent protective measures - hiding, iodine prophylaxis, and evacuation if necessary - are planned and prepared for both the inner and outer sectors. In the inner sector of the zone, hiding would be performed immediately after an accident; in the outer sector, based on environmental monitoring[1].

The emergency planning zone for Temelín Power Plant is shown in the figure below.

[1] More information is available in the "Manual on population protection in the event of a radiation accident at NPP Temelín", available, e.g., at http://www.cez.cz/edee/content/file/energie-a-zivotni-prostredi/temelin/ekalete.pdf

Figure B.I.27: Emergency planning zone for Temelín Power Plant

JE TEMELÍN	TEMELÍN NPP
13 km zóna havarijního plánování	13 km emergency plan zone
Vnitřní 5 km pásmo	5 km internal zone
Evakuační trasy ze zóny havarijního plánování	Evacuation routes from emergency plan zone

In addition to the external emergency plan for population prevention, the power plant also has its own internal emergency plan for staff protection.

B.I.6.1.4.4.1. Internal emergency plan

The NNPP construction site will be integrated into the internal emergency plan as part of its periodic updating. The update will be submitted for approval to the State Office for Nuclear Safety prior to commencement of the activity in question requiring a permit.

The design of the new units will consider all the necessary linkages to emergency response organisation and respect requirements on:

- timely detection of emergencies,
- operative and credible information for assessment of the significance of emergencies,
- securing of means for announcing emergencies,
- securing of means and conditions for managing and performing interventions,

- reduction of irradiation of endangered persons.

Training for employees and other affected persons will be arranged and emergency preparedness reviewed. Based on safety analyses performed, the organisation of the emergency response will involve additional technical equipment and human resources if required.

The updating of the internal emergency plan in relation to the commissioning of the new nuclear units will chiefly include the following amendments:

- emergency response organisation,
- methods of notification and warning of emergencies,
- methods of gathering and hiding,
- methods of evacuation,
- methods of searching for missing persons.

Means for notification and protection of construction workers in the event of an emergency will be secured prior to starting site works.

B.I.6.1.4.4.2. External emergency plan

The holder of the permit to operate NPP Temelín will provide necessary information arising from the new conditions on the site due to the construction and ensuing operation of the additional nuclear units to the South-Bohemian Regional Authority, which shall arrange population protection measures pursuant to the external emergency plan.

Given the substantially improved technical and safety parameters of the new nuclear units, the existing emergency planning and the other measures concerning the population in the area will not have to be extended. More detailed information for defining the emergency planning zone is provided in Chapter D.III.DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS (page 518 in this documentation).

In good advance before the new units are put into operation, the permit applicant will provide the affected state administration authorities with all the information required for updating the external emergency plan.

B.I.6.1.4.5. Safety requirements on the NNPP

B.I.6.1.4.5.1. Construction site selection

In terms of safety, the location of a nuclear facility is subject to a licensing process pursuant to Act no. 18/1997 Coll. on peaceful use of nuclear energy and ionising radiation (Atomic Act), as amended, and Decree no. 215/1997 Coll., on criteria for siting of nuclear installations and very significant ionising radiation sources, as amended.

The project concerns a new construction, while in respect of the original concept for building a nuclear power plant at Temelín, it concerns the completion of the power plant with modern units, including the addition of power voltage evacuation lines to Kočín switchyard and potential increase in the raw water supply capacity from Hněvkovice pumping station to the power plant.

A government-level decision to build four units of a nuclear power plant featuring VVER 1000 reactors at Temelín was made in 1980. Energoprojekt Praha completed the initial project design for units 1 and 2 of NPP Temelín in 1985. The site decision was issued in the same year; the construction permit was issued in November 1986. The construction itself commenced in February 1987 as part of the concept of a total capacity of 4x1000 MW_e on the site; the completion of units 3 and 4 was to be handled as a separate project. The first reflections on rethinking the construction on the site (the need for 4000 MW_e of installed capacity) occurred after 1989, and the project was reassessed in terms of safety. The Czech Government dealt with the construction of NPP Temelín again in March 1993. In its Resolution no. 109/1993, the Government gave its consent to complete two units with a total capacity of 2000 MW_e out of the four units planned originally. The Government confirmed that position in its Resolution no. 472/1999. Temelín Power Plant was commissioned gradually: unit 1 in 2002 and unit 2 in 2003. The infrastructure was completed in the originally planned extent, i.e., for the originally assumed capacity of 4x1000 MW_e.

A great attention was paid to the NNPP site selection from the start of the preliminary works. A series of papers assessing the feasibility of locating a NNPP on the Temelín site was elaborated as part of MIT and

ČEZ assignments between 2005 and 2008. Based on an assessment of territorial parameters in light of legislative and professional criteria, the Temelín site was chosen for the location of a NNPP in South Bohemia. Analyses conducted so far indicate that the construction of the NNPP on the Temelín site is feasible in terms of territorial and technical conditions, namely for capacities up to approximately 2x1700 MW_e. The technical infrastructures of the site were largely constructed for a capacity of 4x1000 MW_e, and any required relays, additions or small-scale rebuilding of some structures and utility networks are not a limiting factor. The construction of the NNPP will have to make use of the historically considered and presently unfenced area at the west of the site (originally intended for the cooling towers of units 3 and 4).

The construction sites for the auxiliary structures (power output to Kočín switchyard and potential increase in capacity of raw water supply pipeline) derive from the choice of the principal NNPP site. They are situated in the corridors of existing lines, which is favourable in terms of both construction and maintenance and the environment.

The chief reasons for choosing the site are summarised as follows:

- raises minimal demands for permanent ALF occupation and zero demands for permanent LIFFF occupation,
- the site was already provided with infrastructures (utility networks, roads, railway sidings) as part of the original construction (infrastructures required for the NNPP have largely been provided, as they had been executed for 4x1000 MW_e before the decision was made to only build 2 units),
- both water collection and wastewater discharge are provided for, so the execution of the NNPP will raise no demands on additional hydraulic structures on the Vltava or any other watercourse,
- the site has sufficient storage areas for depositing inactive sludge from the water treatment operation for the NNPP, solid municipal waste and construction waste,
- trained personnel is provided.

B.I.6.1.4.5.2. Safety classification

In accordance with the Czech legislation, equipment and systems important to assurance of nuclear safety (selected equipment) will be systemically categorised into safety classes depending on its importance with respect to performing safety functions. The categorisation will assume a deterministic approach; it will be accompanied by probabilistic methods as needed. The categorisation of selected equipment employs a tiered approach so that class one includes selected equipment subject to the highest requirements on reliability, qualification, quality assurance, number and scope of inspections, and the related documentation. Specific requirements will be defined for each category in respect of:

- standards and guidelines used in design, manufacturing and construction,
- requirements on power supply assurance,
- qualification for external work conditions,
- seismic classification, categorisation and qualification,
- operability upon the occurrence of an initiating event that can be assumed in the deterministic analyses,
- quality assurance,
- operation inspections and periodic testing,
- requirements on equipment reliability.

Special requirements shall be defined for equipment and systems designed for handling serious accidents. The principle will be that if the performance of safety functions requires the functioning of a system, it also requires the functioning of its respective support systems (assuring e.g. energies, media, lubrication, etc.). The functionality of such systems has to be preserved during all the initiating events assumed by the design.

B.I.6.1.4.5.3. Natural external influences

Seismicity

The seismic hazard for the site has been defined in accordance with IAEA NS-G-3.3 Evaluation of Seismic Hazards for Nuclear Power Plants. The seismic hazard level for the NNPP at Temelín Power Plant is equal to that defined for the existing units of NPP Temelín. Three different approaches were employed to determine the seismic hazard at two levels, SL-1 and SL-2:

- seismostatistical - based on classification of epicentres of historic earthquakes into source regions;
- seismogeological - based on associating earthquake epicentres with active fault lines;
- experimental - based on an evaluation of the dampening characteristics between the epicentre and a nuclear facility.

The value of SL-1 (Seismic Level 1 pursuant to IAEA regulations) is an acceleration level with a return period of 100 years. Concerning acceleration, this level is assumed to have half-sized values. It is a so called operational earthquake, applied to selected combinations of safety-relevant structures.

The value of SL-2 (Seismic Level 2 pursuant to IAEA regulations) is an acceleration level with a return period of 10,000 years, and based on the evaluation, it was set to be no more than 0.08 g. Since the existing IAEA regulations recommend the assumption of a minimum acceleration of 0.1 g, this augmented value is the basic assignment.

The new draft regulation (DS 442) recommends the assumption of a minimum acceleration for SL-2 to be 0.15 g for new nuclear power plants. The minimum required value will be determined based on the regulation in force at the time of project commencement.

The standardised designs for all the units assumed for the construction of the NNPP at Temelín Power Plant declare a much higher design resistance (0.25 g and more) than both the required minimum values in both the IAEA regulation and its new draft and than the actual acceleration determined based on the assessment of the seismic hazard for the site.

The elaboration of the assignment safety report will include an update of the seismic hazard assessment with respect of new available data.

Structures, systems and components of the power plant important to nuclear safety will have functionality assured even for the conditions of SL-2 seismic hazard. For this purpose, the structures, systems and components will be divided into seismic categories depending on their importance to nuclear safety. The seismic categorisation principles are determined primarily by IAEA NS-G-1.6. The design may choose a different formal division into categories, but the principal approach to the seismic categorisation has to comply with the requirements of the said IAEA regulation. The procedure concerning structures unimportant to nuclear safety will follow general technical standards.

Extreme climate effects

The design load with climate effects is defined based on statistical processing of data series for at least a 30-year period of measurement of such events in the area around the NPP Temelín site or an area with a similar landscape character. The statistical processing methods are based on the International Atomic Energy Agency (IAEA) Standards Series no. NS-G-3.4: Meteorological Events in Site Evaluation for Nuclear Power Plants Safety.

The required resistance (design load) to climate events for each structure, system and component is defined based on a classification of their importance to nuclear safety. The effects of climate events are defined for two design levels, which are assumed in different load combinations in accordance with IAEA recommendations. These are the so called design and extreme calculation load for each structure, system and component. For other parts of the power plant that have no relation to nuclear safety, climate loads will be assumed in accordance with general technical standards.

In the case of design load with climate effects, the repetition rate of the event is assumed to be once in 10^2 years. For the extreme load with climate effects, the repetition rate of the event is assumed to be once in 10^4 years. The power plant has to withstand the impact of the extreme calculation load in a way that the performance of the basic safety functions is assured.

The parameters of both the design and extreme calculation load with climate effects have to be defined in accordance with IAEA instruction NS-G-3.4 based on available meteorological data, typically using a Gumbel distribution probability function.

The input meteorological data come from long-term measurements. Measurements at Temelín meteorological station cannot be used directly so far because they have only been carried out since 1989, thus not providing a sufficiently long series of measurement readings. Data from this station can be used to verify the suitability of the selected measurement data set from stations used for the inference of the design values.

Among meteorological phenomena, the wind load is of a major importance for the concept design of the load-bearing framework; the snow load is important for load-bearing frameworks with greater roof spans. Temperature load is only assumed for structures in cases where temperature changes may cause a major stress on load-bearing framework elements.

For the sake of information, the text below quotes the design values of climatic extremes for the existing NPP Temelín units 1 and 2. An update will be made for the new units based on new meteorological data valid as of the project work commencement; moreover, the design values have to consider a forecast of climate trends throughout the period of the assumed lifetime of the units.

Wind: The definition of the load was based on maximum annual measurement readings for momentary wind speeds. The extreme wind load was determined based on data from Churáňov and Praha - Ruzyně stations. Churáňov and Praha - Ruzyně stations provide data series starting in 1971. Praha - Ruzyně shows a better accordance with measurements from Temelín station, perhaps due to the fact that both the stations (Praha - Ruzyně and Temelín) lie in similar landscapes (open surroundings without major obstacles). For this reason, the value determined based on measurements from Praha - Ruzyně, i.e., 49 m/s for the 100-year return and 68 m/s for the 10,000-year return was used as the input value for the wind load (these are so called momentary speeds, which have to be converted to an appropriate integration period for the project based on the methodology adopted for the project design).

Snow: The snow load is expressed as the water rate of snow, i.e., corresponding height of the compensatory water column in mm. The water rate of snow expresses both water in the form of snow and water in the form of humidity and precipitation intercepted by snow. The assessment chooses the water rate of snow measured at Temelín station and at stations within 36 km of the NPP Temelín site. The load was determined conservatively with reference to the climate extremes in recent years as 1.1 kN/m^2 for the 100-year period and 2.0 kN/m^2 for the 10,000-year period.

Extreme temperatures: The extreme strain due to ambient temperatures was determined based on ambient air temperature measurements from the Temelín, Tábor and České Budějovice stations. The following ambient air temperatures were identified.

Table B.I.: Extreme temperature data

	100 years	10,000 years
Maximum annual air temperature [ºC]	39.0	45.6
Minimum annual air temperature [ºC]	-32.7	-45.9
Annual maximum values of six-hour air temperature average [ºC]	38.0	44.4
Annual minimum values of average daily air temperature [°C]	-26.2	-40.4
Annual minimum values of average weekly air temperature [°C]	-19.6	-31.4

Tornado: The tornado intensity assessment uses the Fujita scale. The design parameters of tornadoes in respect of their effect on structures are wind speed, whirlwind advance speed, rotary speed, whirlwind radius, pressure gradient, and pressure decrease rate.

The Czech Republic, and Central Europe in general, is an area with a relatively rare occurrence of tornadoes, and the tornadoes are of little intensity. For these reasons, the existence of tornadoes has not been monitored consistently and continuously in the country; data has only been collected since the 1990s. Tornadoes of intensities F0 and F1 predominate in the CR. Most common damage is to forest vegetation; most commonly documented building damage is to roofs. Any F2 tornadoes are largely in the lower half of the class; building roofs are torn down; greater damage largely occurs on more frail buildings and buildings under construction.

The design tornado assumed for the existing NPP Temelín units is an F2; with respect to the whirlwind parameters, the load effect on safety-relevant structures are covered by the effects of direct extreme wind at the median return rate of 10,000 years.

B.I.6.1.4.5.4. External human-induced impacts

The threats due to human activities were assessed in compliance with the requirements and procedures of IAEA regulations, primarily NS-R-3 Site Evaluation for Nuclear Installations, NS-G-3.1 External Human Induced Events in Site Evaluation for Nuclear Power Plants, and NS-G-1.5 External Events Excluding Earthquakes in the Design of Nuclear Power Plants.

In accordance with these regulations, potential sources of risk within 10 km were identified. Various events that might interact with the NNPP structures were assumed for each source of risk.

A preliminary valuation was made for all the identified sources of risk. The preliminary valuation of a source of risk first valued the effects of the potential interactions of the source of risk with the nuclear facility to be installed. If the identified effects proved to be non-negligible, the frequency (likelihood) of the interaction with the source of risk was also valued. If the preliminary evaluation result was that the risk cannot be ruled out beforehand, a detailed evaluation followed (e.g., the preliminary evaluation of the effect of a fire is based on a sufficient distance from the fire; the detailed evaluation calculates the thermal flow based on the computational model), and a design event was defined if needed (i.e., a requirement on the NNPP structure resistance).

Various events that might interact with the power plant were assumed for each source of risk. Generally speaking, the following example types of events can be assumed: fires, explosions, formation and spreading of clouds of flammable substances, formation and spreading of clouds of toxic substances, formation and spreading of slicks of flammable, corrosive or toxic substances in watercourses, as well as formation and spreading of clouds of oxidising substances, chiefly from internal sources.

The assumed types of events are related to the type of hazardous substance in the given source of risk. Fires are assumed where the hazardous substance is a flammable substance. Explosions are assumed where the hazardous substance is a condensed explosive or taken into consideration where the hazardous substance is a flammable liquid, gas or dispersed dust. The formation and spreading of clouds of flammable substances is associated with fires and explosions and taken into consideration for flammable liquids and gases. The formation and spreading of clouds of toxic substances can be the consequence of a fire if the combustion of the flammable substance produces toxic waste gases, or may occur with liquid and gaseous toxic or corrosive substances. The formation and spreading of clouds of oxidising substances are considered where the hazardous substance is an oxidising liquid or gas. The potential for occurrence of flying objects threatening the power plant is considered for sources where explosions are imaginable.

Industrial buildings

The information on the potential sources of risk comes from the inputs for the analysis and those that assess the risks of potential emergencies in the South-Bohemian Region (input for elaboration of Regional Emergency Plan), as well as input developed pursuant to Act no. 356/2003 Coll. on chemical substances and chemical preparations, as amended, and Act no. 59/2006 Coll. on preventing serious accidents caused by selected hazardous chemical substances and chemical preparations, as amended.

Facilities in the near vicinity - within 10 km of NPP Temelín - include small-scale auxiliary manufacturing in Týn nad Vltavou and Temelín, and a planned ethanol fuel production plant at Býšov. Existing larger-scale industries in the České Budějovice District are situated farther away and it is not expected to expand significantly until 2020. There is no mining industry or oil and gas extraction field in the nearby NPP Temelín vicinity. There are no other nuclear energy facilities within 80 km of the NPP Temelín site.

The following existing and expected sources of potential events were identified:

- transformer oil in Kočín switchyard,
- fuels in Týn nad Vltavou filling station,
- diesel oil in the Wienerberger brickworks,
- sulphuric acid in the Graphite production plant,
- blasting explosives in Slavětice quarry,
- dispersed flammable dust in Býšov ethanol fuel production plant,
- ethanol in Býšov ethanol fuel production plant,
- natural gas in Býšov ethanol fuel production plant,
- ammonia water in Býšov ethanol fuel production plant,
- sulphuric acid in Býšov ethanol fuel production plant.

Based on the results of the detailed valuation, there are no remaining sources of risks, the interaction of which with the NNPP would be non-negligible; there is therefore no reason for determining design events and design parameters for the nuclear facility structures from these sources. Since the analysis performed could not rule out the possibility of the emergence of fires around NPP Temelín producing plumes of smoke and waste gases that might reach the NNPP control room ventilation intakes, a recommendation was made to fit the control rooms with technical equipment and relevant organisational procedures for this case.

Railway transport

The distances of the nearest sections of the specified railways line from NPP Temelín:

• České Budějovice - Strakonice	10.3 km
• České Budějovice - Veselí n. Luž. - Tábor	14.7 km
• Tábor - Bechyně	12.6 km
• Tábor - Písek - Ražice	18.9 km
• Protivín - Čimelice	12.6 km
• Číčenice - Týn n. Vlt.	2.0 km (from NNPP)
• Číčenice - Prachatice	12.1 km
• Dívčice - Netolice	10.4 km
• Veselí n. Luž. - Chlum u Třeboně	21.8 km

The following sources of potential events were identified:

The public railway line:

- railway transportation of ammonia,
- railway transportation of ammonium nitrate.

The railway siding:

- railway transportation of sulphuric acid for the power plant,
- railway transportation of ammonia water for the power plant,
- railway transportation of diesel oil for the power plant.

The following events were evaluated:

- spreading of a toxic cloud,
- explosion of an explosive,
- fire,
- explosion of a cloud.

Based on the results of the detailed valuation, there are two sources of risk, the interaction of which with the NNPP cannot be neglected (nitric acid on the railway siding and ammonia water on the railway siding). This means that spreading of toxic clouds of nitric acid or ammonia vapours from the railway siding has to be included among the design events, and resistance against these events has to be a design parameter. It is recommended that the control rooms are fitted with appropriate technical equipment.

Road transport

Road transport in the broader NPP Temelín vicinity uses the following roads:

Roads within 5 km:

- no. 105, segment Nová Ves - Březí u Týna n.Vlt. - by the SE fencing of NPP Temelín - Týn n. Vlt.

• no. 141, segment Sedlec - Temelín - Záluží	1.1 km
• no. 23, segment Týn n. Vlt. - crossroads Slavětice	5.0 km
• no. 122, Dříteň - crossroads with road no. 105	1.5 km
• no. 138, segment Temelín - crossroads with road no. 105	0.2 km

Roads 5-10 km far:

- no. 105, segment crossroads Chlumec - Nová Ves
- no. 122, segment Nákří - Dříteň
- no. 141, segment crossroads Záboří - Sedlec

- no. 23, segment crossroads Slavětice - Újezd
- no. 105, segment Týn n. Vlt. - Koloděje n. Luž.
- no. 122, segment Týn n. Vlt. - Netěchovice
- no. 23, segment Týn n. Vlt. - crossroads Jarošovice
- no. 147, segment Týn n. Vlt. - crossroads Dobšice

The following sources of potential events were identified:

- transportation of industrial blasting explosives,
- transportation of fuels,
- transportation of gasified petroleum gases in small packages,
- transportation of acetylene in cylinders,
- transportation of acetylene welding kits,
- transportation of ammonium nitrate,
- transportation of ammonia water,
- transportation of sulphuric acid,
- transportation of ethanol.

Based on the results of the detailed valuation, the only source of risk, the interaction of which with the NNPP cannot be neglected is ammonia water. This means that spreading of toxic clouds of ammonia from road no. II/105 has to be included among the design events, and resistance against this event has to be a design parameter. It is recommended that the control rooms are fitted with appropriate technical equipment.

Risky operations inside the power plant

The following events in the facilities and on the transport routes were identified as internal sources of risk, i.e., sources of potential external events that are present inside NPP Temelín:

- chemical storehouse in building 592/01,
- store of technical gases in cylinders in building 642/01,
- hydrogen warehouse in building 643/01,
- diesel oil warehouse in building 703/04,
- gas-burning boiler room,
- natural gas feed line for the boiler room,
- diesel oil distribution lines from diesel oil warehouse 703/04 to tanks at NPP Temelín units 1 and 2,
- hydrogen distribution lines from hydrogen warehouse 643/01 to power generators at NPP Temelín units 1 and 2,
- railway line towards chemical storehouse,
- roadway towards chemical storehouse,
- roadway towards store of technical gases in cylinders,
- roadway towards hydrogen warehouse,
- railway line towards diesel oil warehouse,
- roadway towards diesel oil warehouse.

The detailed analysis of potential interaction indicates that three of the stationary sources and potential mobile sources of transport of four types of chemicals may become sources of adverse interactions with safety-relevant NNPP structures.

They are the following stationary sources:

- presence and replenishment of nitric acid and ammonia water in chemical storehouse (building 592/01),
- diesel oil distribution lines from diesel oil warehouse 703/04 to tanks at NPP Temelín diesel generators,
- hydrogen distribution lines from building 643/01 to NPP Temelín generators.

The mobile sources are:

- railway transportation of sulphuric acid, nitric acid and ammonia water to the chemical storehouse,
- road transport of hydrazine hydrate to the chemical storehouse.

The above sources are capable of producing clouds of toxic substances in an accident. Spreading of toxic clouds will therefore be included among the design events in the NNPP design. In order to compensate for this risk, the control rooms will be fitted with appropriate technical equipment.

Transport pipelines

The transport pipelines have been identified as relevant for the site assessment; they are:

- DN 800 PN 75 high-pressure long-distance gas pipeline,
- DN 1000 PN 75 high-pressure long-distance gas pipeline,
- DN 1400 PN 75 high-pressure long-distance gas pipeline,
- DN 500 PN 4 medium-pressure gas pipeline Zvěrkovice - NPP Temelín (NPP Temelín delivery line),
- DN 200 PN 40 high-pressure gas pipeline Zvěrkovice - Zliv.

A corridor with high-pressure gas pipelines containing natural gas runs at the northwest edge of the Temelín site developed for NNPP construction. In addition to the construction site, site facilities adjoin the corridor as well.

All the gas pipelines are fitted with automated security devices, which shut off the disrupted segment for gas in the event of an accident. That is why the external risk assessment only dealt with the potential danger by diffused gas that might leak from nearby underground gas pipelines. A diffusion barrier was designed; it works passively without requiring any external energy sources. The barrier is continuously monitored for presence of gas by a system linked to the unit control room.

All the three long-distance gas pipelines are fitted with segment shutoff valves with automated emergency action, which automatically shuts off both the ends of the segment in which gas pressure decreases rapidly (3-5 bar a minute). Moreover, the distance between the segment shutoff valves in the segment adjacent to the NNPP is much shorter due to one inserted shutoff valve (SOV), so that the segment running by NPP Temelín is only 7.4 km long compared to the normal length of approximately 25 km. In addition to the normal automated emergency action of shutoff valves, the shutoff valves on all the segments passing by NPP Temelín are fitted with a special Sherlog monitoring system, which makes it possible to immediately detect a gas leak from the pipeline even through very small holes. This special monitoring system is installed at SOV 25 Třitim, SOV 26 Zvěrkovice, SOV 26a Lhota pod Horami, and SOV 27 Budičovice, i.e., on a total of 50 km of the three long-distance gas pipeline sections.

The Zvěrkovice - Zliv gas pipeline connects to the pressure reducing station inside SOV Zvěrkovice station. The safety fast-closure shutoff valves of the pressure reducing series are set so that if the pressure drops below 35 bar (which may only occur in a pipeline accident), the gas inlet to the series is immediately shut off. The shutoff valve SOV2 - Malešice branch is fitted with a check valve, which would prevent gas from flowing back into the ruptured segment coming from Zliv in the event of an accident on the pipeline segment adjoining NPP Temelín. The NNPP delivery line connects to a pressure reducing station for fast-closure shutoff valves for the event of a pressure drop.

The evaluation proved that a gas fire does not have to be included among the design events. An explosion of gas released into the open or drifting of a non-ignited cloud of gas into the power plant and intake of this cloud into the ventilation system of a power plant building is not technically possible (given the specific mass of gas); these events are not included among the design events. Since the seepage of gas could not be ruled out, this event has been included in the design.

Accidental aircraft crash

In accordance with the requirements of Decree no. 215/1997 Coll., the probability of aircraft falling onto the Temelín Power Plant site is analysed, and the results are used to determine a so called design airplane, the fall of which, the power plant has to withstand.

The category of hazards due to random causes includes hazards due to air traffic in the nearby flight corridors and training areas, operation of nearby airports or aviation accidents over the Czech Republic. This hazard arises due to random causes as a consequence of accidental circumstances, technological or human failure.

The power plant itself is situated inside the prohibited zone LK P 2 with vertical boundaries defined from the earth's surface to 1,500 metres above sea level and a horizontal boundary defined as a circle with its centre in the power plant and a radius of 1.1 nautical mile, that is, 2 km. No aircraft is allowed to enter that air space.

No airports are operated in the near vicinity within 10 km of NPP Temelín.

Table B.I.1: Airports within 40 km of NPP Temelín

Name	Intensity of operation (aircraft movements/year)	Name	Intensity of operation (aircraft movements/year)
No. Budějovice	below 5,000, increase, international	Strunkovice	below 5,000
Hosín	below 20,000, international	Tábor	below 10,000
Kramolín SLZ	below 1,000	Tábor Všechov	sporadic
Písek SLZ	below 3,000	Třeboň Dvorce	very low, private
Soběslav	below 3,000	Velešín	low
Strakonice	below 10,000	Bechyně	former military, unused

The assessment of the risk of aircraft crash on the NNPP safety related structures was performed in compliance with the methodology specified in the IAEA document, NS-G-3.1 External Human Induced Events in Site Evaluation for Nuclear Power Plants.

The data for the risk assessment of aircraft crash on a NPP Temelín structure included the updated summaries of the accidents in the territory of the Czech Republic since 1993.

The methodology specified in NS-G-3.1 defines the probability of an aircraft crash on the assessed structure as a sum of the probability of a crash as a result of a general aviation accident, the probability of a crash as a result of take-off and landing operations and the probability of a crash as a result of operation on nearby air routes.

- 1st type of incident: The origin of the aircraft accident is derived from the general regional air traffic. Partial probability is marked P1,
- 2nd type of incident: The aircraft accident happens during an aircraft take-off or landing at a nearby airport. Partial probability is marked P2,
- 3rd type of incident: Aircraft accident is a result of the air traffic in the main civil air corridors and military airstrips. Partial probability is marked P3,

In order to identify those sources of risk, the methodology specified in IAEA documents was used; it considers the following sources of risk that must be included in the assessment. The sources of risk that are outside the specified criteria, can be neglected for the assessment.

- air routes and airport departure and approach corridors, located within 4 km from the structure,
- airport located within 10 km from the structure,
- airport with a designed operating use higher than 500 x D^2 movements a year located within 16 km (where D is the distance of the airport from the structure),
- airport with the designed operating use higher than 1,000 x D^2 movements a year located over 16 km away (where D is the distance of the airport from the structure),
- military establishments and training areas, e.g. type of bombing test range that may endanger the safe operation of the designed structure and are located within 30 km from the structure.

The underlying data necessary for the assessment were provided by the Aeronautical information service, the Air Accidents Investigation Institute, the Joint Forces Command Inspectorate and the Light Aircraft Association of the Czech Republic.

It follows from the assessment of these sources that type 2 and 3 incidents can be neglected in the location of NPP Temelín, and thus the partial probabilities P2 and P3 are zero. That means that the location is only endangered by accidents of general air traffic over the territory of the Czech Republic. There are no standard air corridors within 4 km and no airports operated within 10 km from the location. The more distant airports can be neglected with respect to the above specified excluding criteria.

The probability calculation for P1 is based on the summary of aircraft accidents over the territory of the Czech Republic for individual categories of aircraft. The probability of the danger by the crash of a large airliner for accidental causes is neglected with respect to its extremely low probability. Expert estimates of the danger for this category of the air traffic range between 10^{-10} and 10^{-11} which is several orders below the limit probability stipulated by the Decree.

The same sources of danger (per km^2) apply to the units of NNPP as for the existing units of NPP Temelín 1, 2, where the assessment is a part of the updated pre-operational safety report. For the existing units, the design aircraft considers civil aircraft with a weight of 7 tonnes, at the impact speed of 100 m/s.

The design aircraft specific for the NNPP will be specified during the processing of the preliminary safety report when the effective area (i.e. the area of the nuclear power plant important in terms of nuclear safety) will be known.

Deliberate aircraft crash

The specific area applies to the threat of aircraft impact as a result of a deliberate attack. After the New York terrorist attacks on 11 September 2001 all nations with advanced nuclear technology increased protection of nuclear facilities against attacks carried out using a large airliner. Unlike aircraft impacts as a result of accidental causes, this is an entirely different problem and also the method of protection, based mainly on preventive measures, is entirely different.

The primary protection against deliberate attacks (not only using an aircraft) is the responsibility of the state. This applies both to nuclear facilities, and other areas of industry and life. The state has a variety of means available (intelligence agencies, army, police, terrorist activity monitoring, airspace protection, prevention in the conditions of air transport, special units etc.) and their use through the Ministry of Defence of the Czech Republic, Ministry of the Interior of the Czech Republic and SÚJB means the high probability that the risk of a successful terrorist attack on a nuclear facility is eliminated and minimised.

The opinion of the Ministry of the Interior of the Czech Republic regarding the above-specified issues was requested. In the letter ref. no. MV-62111-2/OBP-K-2009 of 24 September 2009, the Ministry specifies that in order to provide the safety of nuclear facilities against terrorist attacks, including a potential attack using a civil airliner, the safety measures corresponding to the topicality of the safety threat are in place.

Those safety measures include:

- intelligence and information security,
- safety measures in air transport,
- airspace protection.

It further specifies that at present the level of safety measures in order to ensure the minimising of terrorist attacks against nuclear facilities (including attack using civil aircraft) is high and it complies fully with the measures in the other countries of the European Union. The monitoring of the safety situation further indicates that the Czech Republic has not been in direct danger from international terrorist groups.

The specified data are only of general nature. In accordance with the above-specified information of the Ministry of the Interior, it is impossible, for understandable reasons, to include the sensitive intelligence and specific operative procedures of individual security bodies.

B.I.6.1.4.5.5. Provision of nuclear safety in already operated systems

For individual stages of the construction of new nuclear units, i.e. the preparation, designing, construction, commissioning and the operation, a full set of rules and regulations enabling the systematic identification, evaluation and subsequent permission of the processes and activities with a potential impact on the safety of the operated units will be designed. The system will be designed using a principle of structured approach and it will be documented in accordance with the requirements of the SÚJB Decree no. 132/2008 Coll. on Quality Assurance System in carrying out activities connected with utilisation of nuclear energy and radiation protection and on Quality assurance of selected equipment in regard of its assignment to classes of nuclear safety, as amended.

B.I.6.1.4.6. Radiation protection

B.I.6.1.4.6.1. Basic information

The new structures of units 3 and 4 will become part of a nuclear facility in accordance with Section 2 (h) (1) the Nuclear Act and will be a category IV workplace. The equipment of individual rooms inside the structures will be designed depending on the nature of work and properties of the radioactive substances present in the respective technological facilities. Depending on the danger level of the sources of ionising radiation, the controlled and monitored areas will be defined. Only category A radiation staff shall work in the controlled area. Other persons may only work or stay in the controlled area if the controlled area operator ensures that their irradiation does not exceed the general limits.

The project for the new units will be designed so that irradiation may be planned and maintained as low as reasonably achievable (ALARA) with respect to the economic and social aspects. At the same time, the respective limits of exposure or optimisation limits set by the Decree on radiation protection shall be respected.

B.I.6.1.4.6.2. Radiation monitoring

Radiation monitoring systems

The NNPP will introduce the system of radiation protection control, verification and evaluation, supervision of compliance with the radiation protection requirements within a scope at least corresponding to the existing radiation protection system in the Temelín Power Plant that is used to satisfying the following functions:

- monitoring of people,
- monitoring of the surroundings,
- monitoring of workplace,
- monitoring of discharges.

Monitoring of people

The system of personal radiation monitoring provides for monitoring people staying or working in the controlled NNPP areas. All people entering the controlled area are monitored using dosimeters, both in terms of external exposure and internal contamination.

The evaluation of the level of external exposure of persons will be provided similarly to the existing NPP Temelín units by assigning personal (passive or active) dosimetric devices. The evaluation of internal exposure is performed at least once a year for radiation staff. The internal exposure can be established using a full-body computer which measures the distribution and activity of individual radionuclides in the organism and activity of thyroidal radioactive iodine.

Monitoring of the surroundings

The main task of monitoring the surroundings is to detect and monitor the potential exposure of the population in the neighbourhood of the nuclear power plant based on the knowledge of respective radiation parameters, including the values of dose rates or specific activities of radionuclides in individual components of the environment.

The monitoring is performed in the following extent of values:

- photon dose equivalent input measurement,
- measurement of volume activities of aerosols in the air,
- measurement of volume, specific and area activities of the samples of the environment (mainly agricultural products),
- measurement of area activities of radionuclides in atmospheric fall-outs,
- measurement of volume activities of surface and underground waters on the premises and the neighbourhood of NPP Temelín.

For reference purposes, the National Radiation Protection Institute (SÚRO) carries out independent monitoring at its monitoring stations in the neighbourhood of Temelín. The extent of independent monitoring is documented in Chapter C.2.3.3. Ionising radiation (page 262 hereof), the following figure shows the extent of the independent SÚRO monitoring network in the neighbourhood of NPP Temelín.

Figure B.I.28: Extent of the independent SÚRO monitoring network around Temelín NPP

JE TEMELÍN	TEMELÍN NPP
Spady	Fallouts
Povrchové vody – řeka (Vltava)	Surface waters - river (Vltava)
Povrchové vody – nádrže	Surface waters - reservoirs
Složky potravních řetězců (mléko, brambory, zelenina, ovoce, obiloviny)	Food chain components (milk, potatoes, vegetables, fruit, cereals)
TLD – síť – lokální	TLD - network - local

Monitoring of workplace

The system of radiation monitoring of the category IV workplace is used to control the radiation situation in individual structures as well as to control the radiation situation of individual technological systems of the power plant potentially containing radioactive media. That way the system provides immediate information regarding changes to the radiation situation in technological systems of the power plant and related working spaces.

The data from individual detectors of the radiation monitoring systems are sent to the control units near the point of monitoring and at the same time transferred to the radiation control central control room. The safety-significant radiation parameters are also transferred to the unit control rooms via the safety control units. That way the system provides timely detection of excess reference levels of significant radiation parameters and the prognosis of further development. The system includes data archiving, their evaluation and comparison to reference values.

The systems are designed in order to be capable of performing the functions specified by the project and SÚJB decisions both during normal states of operation and under emergency conditions.

Within the workplace monitoring programme the measurement of surface contamination of persons, as well as structures, is provided using stationary and portable devices located mainly:

- in the locker rooms on the boundary of the entrance to the controlled area,
- at the exit from the controlled area,
- in sanitary nodes, laboratories and in sanitary facilities in the controlled area,
- in other locations where surface contamination may occur.

The specific case includes the ensuring of radiation control on the boundary or the guarded area. The control of people and vehicles is and will further be provided by the equipment located in the siding, backup and main gatehouse.

Identification of potential leakages of radioactive substances to the environment is provided using the teledosimetric system (TDS) which is used for continuous control of the dose equivalent input. The system consists of 24 monitoring points located in one circuit within the existing NPP Temelín premises.

Monitoring of discharges

The system of discharge monitoring is used to monitor radioactive substances discharged into the air or watercourses from the power plant and provides control for not exceeding the authorised limits of discharges set by the State Office for Nuclear Safety and, in the case of liquid discharges, also by the Regional Authority of the South Bohemia Region.

The gaseous discharges are monitored in order to ensure controlled observance of the specified legislation and authorised limits and signalling of an excess of reference levels for any leakage of radioactive substances into the environment. The control of monitoring of gaseous discharges includes:

- control of the observance of the specified limits for radioactive substance discharge into the environment during operation under normal conditions as well as emergency and post-emergency situations,
- signalling of radioactive substance leakage into the environment and specifying the amount of the activity leaked into the environment through the ventilation stacks under emergency conditions.

Balance (off-line) monitoring of gaseous discharges is provided based on the sampling and subsequent spectrometric evaluation. The system includes the gamma-spectrometric measurement of the samples of aerosols, iodine, inert gases, carbon and tritium. The sampling of representative samples is provided using the respective sampling devices that are subject to regular calibrations and verifications performed by the authorised metrological centre.

Liquid discharges are monitored in order to ensure the controlled observance of the specified limits and signalling of liquid radioactive substance leakage. If the permitted activity of liquid discharges from the selected control reservoirs is exceeded, the system will provide for the interruption of their discharge.

The control of liquid discharges is provided using continuous and discontinuous monitoring of the activity of waters released from the NPP Temelín premises and is used to provide for the balancing of discharged radioactive substances. The control is also meant to prevent undesirable leakage of radioactive substances into the environment, to signal the exceeding of set reference levels and to provide interruption of the discharge upon achieving the intervention levels when emptying individual control reservoirs.

B.I.6.1.4.7. Physical protection

The basic goal of the physical protection of the NNPP will be to provide protection for the nuclear materials and nuclear facilities against an attack made from the outside by a group of attackers with defined knowledge, equipment and gear. The most serious objectives of such attack within that meaning will be:

- an attempt to steal nuclear materials,
- an attempt to carry out radiological sabotage.

The physical protection system will fully reflect the considering, incorporating and assessing of the capabilities of the physical protection system to react to the defined project “Basic threat for nuclear facilities and nuclear material including the transport of nuclear material in the Czech Republic”, which was processed and is updated continuously by the established Interdepartmental Workgroup (MPS PZH).

The system of physical protection of NNPP will be fully implemented into the functional and maintained system of the physical protection used to secure the already operated nuclear units on the premises where the construction and launch of the NNPP will be carried out.

During the construction of the NNPP, the holder of the licence will implement administrative and technical measures in order to provide compliance with the requirements of Section 13 of Decree no. 144/1997 Coll., i.e. the provision of physical protection during construction of a new nuclear power plant. Those measures will include:

- the construction site of the NNPP will be fenced and its protection, including the monitoring upon entrance of persons, means of transport and building mechanisms, will be provided,
- starting from the beginning of the installation of technological equipment, the structure of the NNPP will be protected on a level that meets the requirements of category III in terms of providing physical protection,
- the construction site of the NNPP will be fully separated from the operated parts of the existing operated nuclear power plant.

B.I.6.2. Main technical data

Within the project the units with power ranging from 1000-1700 MW_e with III+ generation PWR reactors will be used. This choice resulted from the technical and economic studies and analysis performed before the notification of intent pursuant to the act on environmental impact assessment was filed. The studies considered the properties of the location, technical and safety parameters of the PWR types as well as the BWR or PHWR types, tendencies in the demand and offer on the electric power market and other aspects having an impact on the project viability.

The following technical description specifies the project's technical parameters in the extent and detail required for the intended objective of environmental impact assessment. When working with parameters that, based on their nature and available information, can only be specified in a certain extent, the so called conservative approach is chosen and the less favourable values, with respect to environmental impacts, are always considered in the evaluation. This approach is intended to provide the possibility to state at the end that the actual negative environmental impact will be smaller than that prognosticated. Thus there will be no risk that the decision regarding the project location might be affected to the detriment of environmental protection as a result of the use of uncertain data.

The following text focuses on the safety, technological and construction parameters of the project that characterise the selected type of the power reactor and related systems and structures. Separate subchapters give further examples of possible applications of this type as they are currently presented by some important companies. Naturally, this is not meant as an exhaustive or short list, which might exclude any other candidate from participation in the tender in accordance with the respective European legal regulations.

The following table summarises the main technical data of the project.

Table B.I.2: Main technical data for NNPP (data for 1 unit)

General data	
Gross power [MW_e]	1,198 - 1,750
Actual power [MW_e]	1,113 - 1,650
Thermal power [MW_t]	3,200 - 4,500
Core Circuit	
Main circulation loops	4
Core circuit flow rate [m^3/s]	19.87 - 31.47
Operating (nominal) pressure [MPa]	15.5 - 16.2
Secondary circuit	
Steam flow rate at normal conditions [kg/s]	1,780 - 2,552
Steam temperature/pressure [°C/MPa]	272.78 - 292.5/5.76 - 7.71
Reactor core	
Core height [m]	3.73 - 4.267
Core equivalent diameter [m]	3.04 - 3.9
Fuel assemblies	157 - 241
Bundles with absorption elements	69 - 121
Fuel quantity [t UO_2]	87 - 157
Mean fuel burn - up (nominal) [MW_d/kg]	60 - 70
Fuel cycle length [months]	12 - 24
Reactor pressure vessel	
Cylindrical body inside diameter [mm]	4,038.6 - 5,200
Cylindrical body wall thickness [mm]	200 - 300
Total height [mm]	11,185 - 13,944
Main coolant pumps	
Quantity	4
Nominal flow rate [m^3/h]	17,886 - 28,320
Pressuriser	
Total volume [m^3]	59.5 - 82
Design pressure [MPa]	17.1 - 17.6
Steam generators	
Quantity	2 - 4
Type	vertical/horizontal with U-tubes
Maximum outside diameter [mm]	5,066 - 6,096
Total height/length [mm]	13,820 - 24,621
Inside leak-proof envelope	
Design	pre-stressed concrete with steel lining/steel
Volume [m^3]	58,333 - 80,000
Outside containment	
Design	reinforced concrete

As mentioned above, units with pressurised water reactors (PWR) will be used for the project, while none of the available types of pressurised water reactors that comply with all terms specified by the decisions of regulatory authorities are excluded.

The following types of reactors are considered as reference:

- European pressurised reactor EPR,
- Pressurised water reactor AP1000,
- Pressurised water reactor AES-2006 (trade name MIR-1200),
- Pressurised water reactor EU APWR.

These various technical designs do not represent the project variants that would be decided among each other in the environmental impact assessment. The environmental as well as safety requirements for all types of the reactors are the same and the impacts are considered in their potential maximum.

The following subchapters provide the technical data for the above-specified reference types of reactors; for comparison, the data for the existing operated Temelín Power Plant are also specified.

B.I.6.2.1. Power plant with EPR unit

It is a project developed by Areva as an improvement of the N4 and KONVOI reactors currently operated in Germany and France.

It is licensed in the country of origin, i.e. in France, Finland and also in China; the licensing is being processed in the USA and United Kingdom. In the countries where the license was granted it is already being built. It applies to the location of Flamanville in France, Olkiluoto in Finland and Taishan in China. The French power-producing company EdF, the largest global operator of nuclear power plants, considers this type of reactor for the general renewal of its nuclear plants.

The EPR project includes active safety systems for handling design accidents consisting of four divisions. Each is capable of satisfying the required safety function. Each division is located in a different safety system building and individual safety systems within a single building are physically separated from each other. That significantly reduces the risk of simultaneous failure of all safety systems as a result of internal as well as external impacts, e.g. fire or aircraft crash.

These systems reduce the probability of the incidence of a severe accident to an acceptable level. Even so, the EPR unit is designed so that even in the case of a severe accident the containment tightness is preserved and thus the reduction of impacts on the neighbourhood will be provided in terms of time and the size of the affected area. The containment is capable of handling both high pressure and temperature, even in the case of a severe accident with reactor core melt and reactor vessel meltdown.

If the core melts through the reactor vessel, the melt will be trapped, spilled and cooled in a special constructed trap inside the containment using water from the reservoir located inside the containment.

Figure B.I.29: Schematic of a unit with an EPR reactor

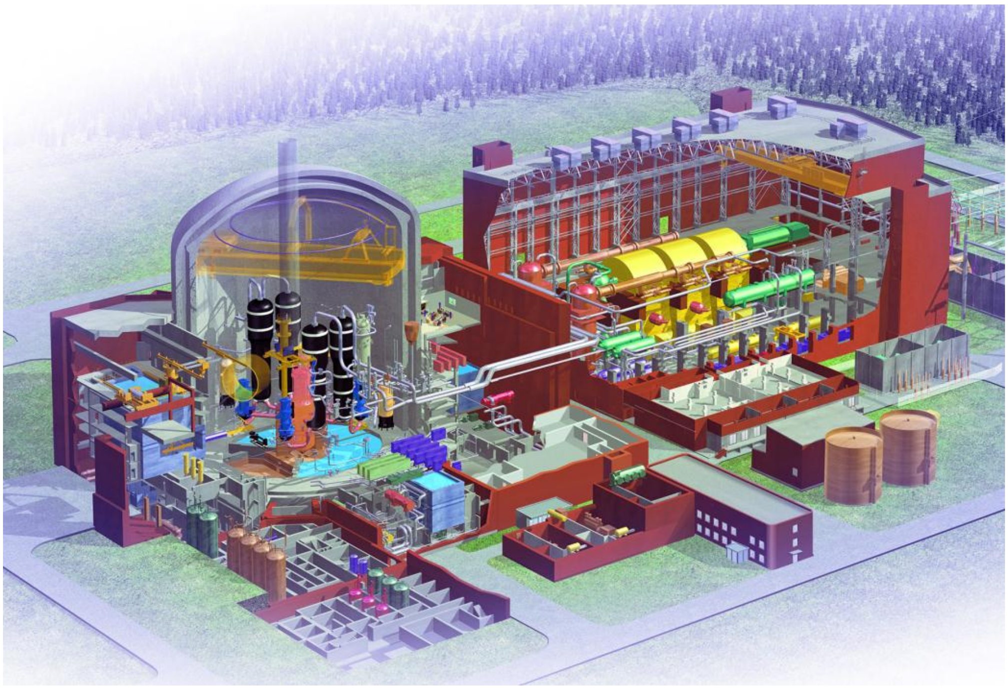


Table B.I.3: Basic EPR unit technical data

General data	
Gross power [MW_e]	1,750
Actual power [MW_e]	1,650
Thermal power [MW_t]	4,500
Core Circuit	
Main circulation loops	4
Core circuit flow rate [m^3/s]	31.47
Operating (nominal) pressure [MPa]	15.5
Secondary circuit	
Steam flow rate at normal conditions [kg/s]	2,552
Steam temperature/pressure [°C/MPa]	292.5/7.71
Reactor core	
Core height [m]	4.2
Core equivalent diameter [m]	3,.767
Fuel assemblies	241
Bundles with absorption elements	89
Fuel [t UO_2]	144
Reactor pressure vessel	
Cylindrical body inside diameter [mm]	4,870
Cylindrical body wall thickness [mm]	250
Total height [mm]	13,722
Main coolant pumps	
Quantity	4
Nominal flow rate [m^3/h]	28,320
Pressuriser	
Total volume [m^3]	75
Design pressure [MPa]	17.6
Steam generators	
Quantity	4
Type	vertical with U-tubes
Maximum outside diameter [mm]	5,168
Total height/length [mm]	24,621
Inside leak-proof envelope	
Design	Pre-stressed concrete with steel lining
Volume [m^3]	80,000
Outside containment	
Design	reinforced concrete

B.I.6.2.2. Power plant with AP1000 unit

It is a project of American Westinghouse, which is based on the AP600 model.

It has obtained a licence in the USA and China; among European countries it is currently being licensed by the UK nuclear authorities. At present the implementation of the first four units in Sanmen and Haiyang in China is in progress.

The AP1000 unit is provided with so called passive safety systems for handling design accidents. They are capable of transferring and maintaining the unit in a safe state even without the intervention of the unit control room staff or the need of an external power supply. Instead of relying on the so called active components, e.g. pumps or diesel-generators, natural physical laws are used as a source of energy - gravity, natural circulation and drive using compressed gas expansion.

However, it does not mean that the AP1000 power plant does not use active systems, however they are not indicated as safety systems.

In the case of core melting, the project is capable of cooling down the melt inside the reactor vessel and preventing it melting through.

Figure B.I.30: Schematic of a unit with an AP1000 reactor

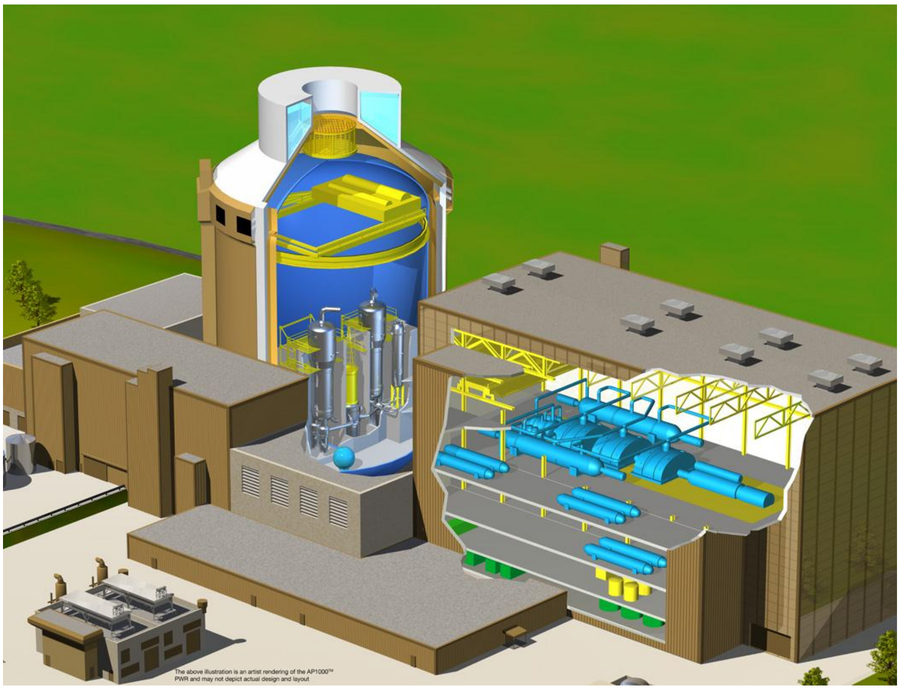


Table B.I.4: Basic AP 1000 unit technical data

General data	
Gross power [MW_e]	1,200
Actual power [MW_e]	1,117
Thermal power [MW_t]	3,415
Core Circuit	
Main circulation loops	2 hot branches / 4 cold branches
Core circuit flow rate [m^3/s]	19.87
Operating (nominal) pressure [MPa]	15.5
Secondary circuit	
Steam flow rate at normal conditions [kg/s]	1,886
Steam temperature/pressure [°C/MPa]	272.78/5.76
Reactor core	
Core height [m]	4.267
Core equivalent diameter [m]	3.04
Fuel assemblies	157
Bundles with absorption elements	69
Fuel [t UO_2]	95.97
Reactor pressure vessel	
Cylindrical body inside diameter [mm]	4,038.6
Cylindrical body wall thickness [mm]	203
Total height [mm]	13,944
Main coolant pumps	
Quantity	4
Nominal flow rate [m^3/h]	17,886
Pressuriser	
Total volume [m^3]	59.5
Design pressure [MPa]	17.1
Steam generators	
Quantity	2
Type	vertical with U-tubes
Maximum outside diameter [mm]	6096
Total height/length [mm]	22,460
Inside leak-proof envelope	
Design	steel
Volume [m^3]	58,333
Outside containment	
Design	reinforced concrete

B.I.6.2.3. Power plant with AES-2006 unit (trade name MIR-1200)

It is a Russian project by Atomstroyexport, owned by the Russian state company Rosatom. This project is based on the projects and experience from the operated VVER-1000 reactors, which are used in the Temelín Nuclear Power Plant as well as other countries, mainly in Central and Eastern Europe.

The AES-2006 project (which received the trade name MIR-1200 for the European market) is licensed in Russia; its “smaller” versions, powered with 1000 MW_e, are licensed in India, China and Bulgaria. At present the construction of these units is in progress within the Novovoronezh and Leningrad nuclear power plants, and recently the construction of the above-mentioned “smaller” versions has been completed in the locations of Tianwan, China, and Kudankulam, India.

Like the EPR project, the AES-2006 project uses four divisions of active safety systems for handling design accidents, however, they are completed with other passive systems for heat removal from steam generators and the inside containment area.

In the case of core melting from the reactor vessel, the trap for its interception and subsequent after-cooling using the water reserve in the containment is ready.

Figure B.I.31: Schematic of an AES-2006 reactor unit (trade name MIR-1200)

Table B.I.5: Basic AES-2006 project technical data (trade name: MIR-1200)

General data	
Gross power [MW_e]	1,198
Actual power [MW_e]	1,113
Thermal power [MW_t]	3,200
Core Circuit	
Main circulation loops	4
Core circuit flow rate [m^3/s]	23.9
Operating (nominal) pressure [MPa]	16.2
Secondary circuit	
Steam flow rate at normal conditions [kg/s]	1,780
Steam temperature/pressure [°C/MPa]	286/7
Reactor core	
Core height [m]	3.73
Core equivalent diameter [m]	3.16
Fuel assemblies	163
Bundles with absorption elements	121
Fuel [t UO_2]	87
Reactor pressure vessel	
Cylindrical body inside diameter [mm]	4,250
Cylindrical body wall thickness [mm]	200
Total height [mm]	11,185
Main coolant pumps	
Quantity	4
Nominal flow rate [m^3/h]	21,500
Pressuriser	
Total volume [m^3]	79
Design pressure [MPa]	17.6
Steam generators	
Quantity	4
Type	horizontal with U-tubes
Maximum outside diameter [mm]	5,100
Total height/length [mm]	13820
Inside leak-proof envelope	
Design	Pre-stressed concrete with steel lining
Volume [m^3]	74169
Outside containment	
Design	reinforced concrete

B.I.6.2.4. Power plant with EU-APWR unit

It is a Japanese project by Mitsubishi Heavy Industries, based on the 1538 MW_e AWPR-project. The company uses the experience gained in the twenty-four operating nuclear power plants supplied by Mitsubishi in Japan.

This new type has been adapted to the requirements of the European and American markets; its licensing is in progress in Japan and the USA. Like the EPR and AES-2006 projects, the EU-APWR project uses four divisions of active safety systems for handling design accidents.

In the case of core melting from the reactor vessel, the trap for its interception and subsequent after-cooling using the water from the reservoirs located outside the containment is ready.

Figure B.I.32: Schematic of a unit with an EU-APWR reactor

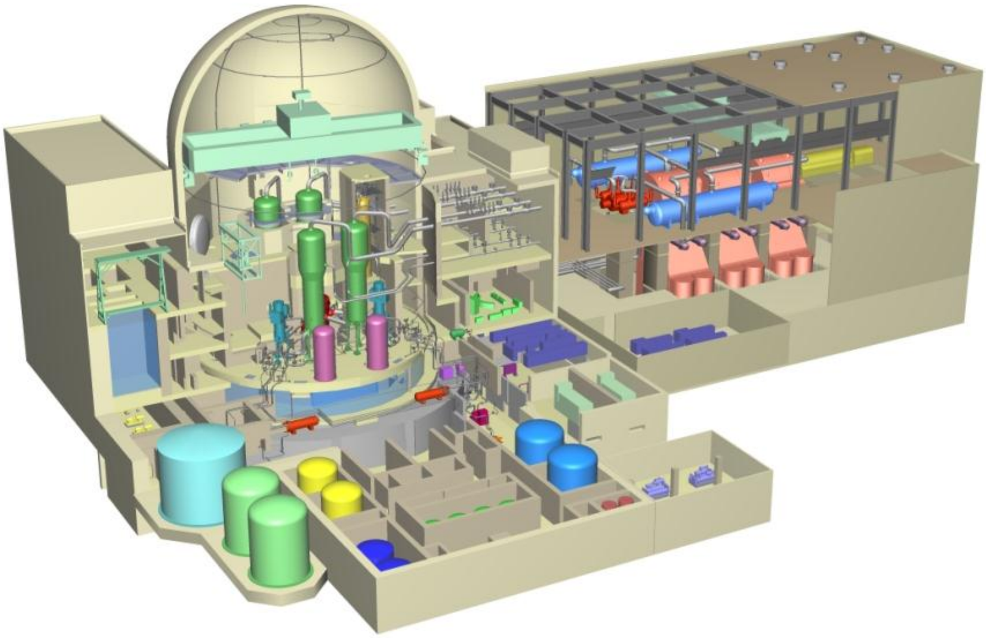


Table B.I.6: Basic technical data for EU-APWR unit

General data	
Gross power [MW_e]	1,700
Actual power [MW_e]	1,630
Thermal power [MW_t]	4,451
Core Circuit	
Main circulation loops	4
Core circuit flow rate [m^3/s]	28.22
Operating (nominal) pressure [MPa]	15.5
Secondary circuit	
Steam flow rate at normal conditions [kg/s]	2,545
Steam temperature/pressure [°C/MPa]	283/6.69
Reactor core	
Core height [m]	4.2
Core equivalent diameter [m]	3.9
Fuel assemblies	257
Bundles with absorption elements	69
Fuel [t UO_2]	157
Reactor pressure vessel	
Cylindrical body inside diameter [mm]	5,200
Cylindrical body wall thickness [mm]	300
Total height [mm]	13,600
Main coolant pumps	
Quantity	4
Nominal flow rate [m^3/h]	25,400
Pressuriser	
Total volume [m^3]	82
Design pressure [MPa]	17.1
Steam generators	
Quantity	4
Type	vertical with U-tubes
Maximum outside diameter [mm]	5,066
Total height/length [mm]	21,700
Inside leak-proof envelope	
Design	Pre-stressed concrete with steel lining
Volume [m^3]	79,000
Outside containment	
Design	reinforced concrete

B.I.6.2.5. Existing Temelín Power Plant with VVER 1000 unit

It is representative of 2nd generation pressurised water reactors. It was supplied by the Russian company Atomstroyexport, the original project was completed by Energoprojekt Praha. In the Temelín Nuclear Power Plant there are two VVER 1000 units type V320 (out of four originally planned). After the initial audits the condition of the change in the control system was accepted; it was later delivered by Westinghouse. The power plant level was checked by independent expert commissions several times; its safety was certified repeatedly.

Figure B.I.33: Schematic of the existing NPP Temelín VVER 1000 unit

Table B.I.7: Basic technical data for the existing NPP Temelín VVER 1000 unit

General data	
Gross power [MW_e]	1,020
Actual power [MW_e]	970
Thermal power [MW_t]	3,000
Core Circuit	
Main circulation loops	4
Core circuit flow rate [m^3/s]	23.5
Operating (nominal) pressure [MPa]	15.7
Secondary circuit	
Steam flow rate at normal conditions [kg/s]	1,633
Steam temperature/pressure [°C/MPa]	278.5/6.3
Reactor core	
Core height [m]	3.63
Core equivalent diameter [m]	3.16
Fuel assemblies	163
Bundles with absorption elements	61
Fuel [t UO_2]	92
Reactor pressure vessel	
Cylindrical body inside diameter [mm]	4,100
Cylindrical body wall thickness [mm]	200
Total height [mm]	10,900
Main coolant pumps	
Quantity	4
Nominal flow rate [m^3/h]	21,200
Pressuriser	
Total volume [m^3]	79
Design pressure [MPa]	17.1
Steam generators	
Quantity	4
Type	horizontal with U-tubes
Maximum outside diameter [mm]	4,500
Total height/length [mm]	13,800
Inside leak-proof envelope	
Design	prestressed concrete with steel lining
Volume [m^3]	56,600
Outside containment	
Design	-

B.I.6.3. Technological project design data

The design of all systems and structures will meet the legislative requirements and the requirements of the standards (see Chapter B.I.6.1.4.1. above), containing also the requirements for minimising environmental impact risks.

B.I.6.3.1. Mechanical and technological part

B.I.6.3.1.1. Primary part

The primary parts consists of the core circuit, safety systems, core circuit auxiliary systems and the containment system.

In compliance with legislation and standards, special attention will be paid to the primary part equipment forming the barrier against radioactive leaks for the duration of the project (design, manufacture, installation, commission and operation) with respect to its role in providing nuclear safety and radiation protection. The design of the equipment will ensure that it will not be damaged as a result of specific conditions related to the presence of the radiation in these systems or as a result of conventional load (present also in traditional power plants). Those include the impacts of high pressure, high temperature, cyclic load, circulation etc. resulting in excessive deformation, corrosive and erosive damage, temperature and radiation ageing of materials and equipment etc. The project will include a sufficient reserve for operation up to the planned life-span of 60 years and the changes resulting from ageing will be monitored and considered by the controlled ageing programme.

B.I.6.3.1.1.1. Core circuit

The main components of the PWR core circuit include: a pressurised water reactor, steam generators, main coolant pumps, main circulation line, pressuriser, pressuriser safety valve node or other system performing similar functions.

The core circuit uses forced circulation, provided by the operation of main coolant pumps, to transfer the heat generated by the core via the steam generators to the secondary circuit in order to ensure that the specified temperature range is kept for the core and the core circuit coolant. At the same time it provides the sufficient natural circulation required to achieve the transfer of residual heat from the core to the steam generators when the reactor is shut down and the main coolant pumps do not operate.

The core circuit is designed in order to perform the following functions:

- core cooling and heat removal from the core to steam generators by providing the following sub-functions:
  - temperature control of the coolant in the core,
  - pressure control of the coolant in the core,
  - maintaining integrity of the pressure interface,
  - coolant flow control through the core,
- core reactivity control,
- containing radioactivity using the second barrier (core circuit pressure boundary).

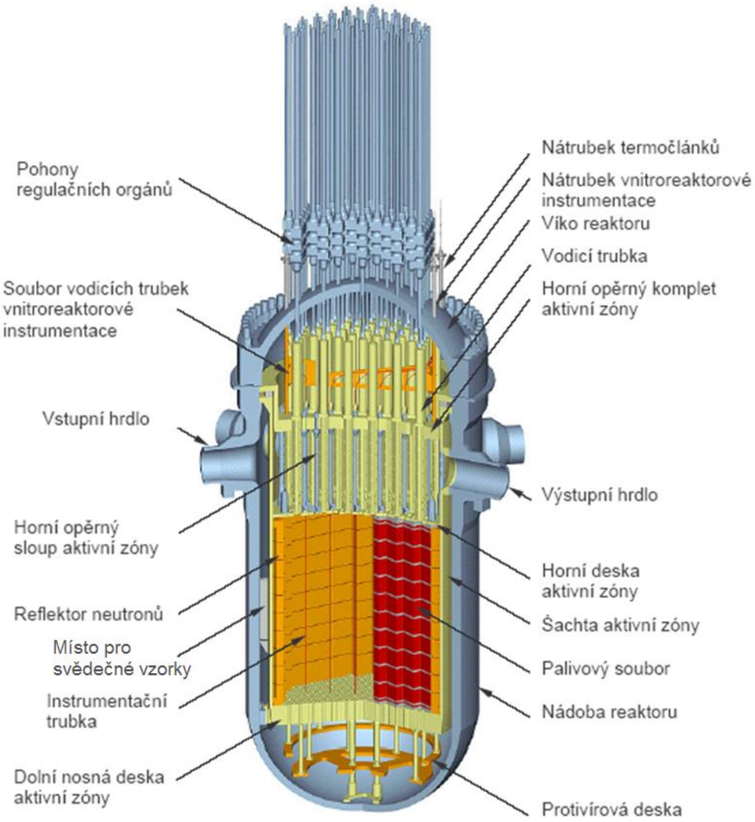
Reactor

The following figure shows the typical reactor design. It is a pressure vessel consisting of the reactor vessel and head, inside built-in structures located in the reactor vessel (e.g. core shaft, neutron reflector etc.) and the drives of control elements and instrumentation located on the reactor head.

The main functions of the reactor include the mounting of the core, providing a sufficient amount of moderator (in case of a PWR reactor used also as the coolant) required to keep the chain fission reaction in the core and maintaining the core circuit tightness.

The coolant enters the reactor using the inlet connections, it flows through the circular gap between the vessel body and the core shaft and penetrates the core from below. Upon passage through the core, the coolant heats up utilising the fission reaction of the nuclear fuel and leaves the reactor using the outlet connections.

Figure B.I.34: Possible PWR-type reactor structural design



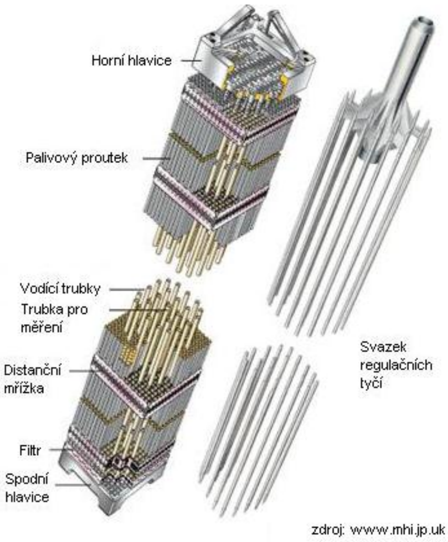
Pohony regulačních orgánů	Control rod drives
Soubor vodících trubek vnitroreaktorové instrumentace	Bundle of reactor instrumentation guide tubes
Vstupní hrdlo	Reactor coolant inlet nozzle
Horní opěrný komplet aktivní zóny	Upper plate of protective tubes assembly
Reflektor neutronů	Neutron reflector
Místo pro svědečné vzorky	Witness samples compartment
Instrumentační trubka	Instrumentation thimble
Dolní nosná deska aktivní zóny	Core support plate
Nátrubek termočlánků	Thermocouple socket
Nátrubek vnitroreaktorové instrumentace	Reactor instrumentation socket
Víko reaktoru	Reactor pressure vessel lid
Vodicí trubka	Control rod protective tube
Horní opěrný komplet aktivní zóny	Protective tubes assembly
Výstupní hrdlo	Reactor coolant outlet nozzle
Horní deska aktivní zóny	Bottom plate of protective tubes assembly
Šachta aktivní zóny	Core barrel
Palivový soubor	Fuel assembly
Nádoba reaktoru	Reactor pressure vessel
Protivírová deska	Anti-vortex plate

The controlled chain reaction and the transfer of heat produced by the reaction to the coolant takes place in the core. The core consists of the fuel assemblies, located most often in a square or hexagonal grid. The fuel assembly mainly consists of fuel rods, guide tubes, spacer grids and heads.

The fuel rods consist of fuel pellets which are enclosed in the tubes from a special alloy, most often of zirconium basis. The purpose of the cladding is to keep the fuel rod geometry, provide the heat transfer from the fuel to the coolant and at the same time to maintain the radioactive fission products in the fuel.

The guide tubes establish the channels for introducing either the bundle of final control elements, neutron source or the rods with burnable poison. The measurement tube is located in a central position and creates the channel for introducing the internal neutron detector.

Figure B.I.35: Fuel pellet, fuel rod and fuel assembly



Horní hlavice	Top nozzle
Palivový proutek	Fuel rod
Vodící trubky	Guide thimble
Trubka pro měření	Instrumentation tube
Distanční mřížka	Spacer grid
Filtr	Anti debris filter
Spodní hlavice	Bottom nozzle
Svazek regulačních tyčí	Cluster of control rods
Zdroj: www.mhi.jp.uk	Source: www.mhi.jp.uk

The reactor power will be controlled through the combination of inherent nuclear characteristics of the core, its temperature and hydraulic characteristics and the capability of the control system and the reactor fast shutdown system.

The fuel is placed in the reactor using the fuel charging machine in accordance with the calculated optimised charging scheme. The thermal and hydraulic project limits, including e.g. maximum linear thermal power of the fuel rod, minimum reserve to the boil crisis, maximum temperature of fuel and cladding, will be specified and verified within the preparation of each of the charges in order to provide sufficient reserve.

Steam generator

The steam generator is a pressure vessel with horizontal or vertical design, with feedwater and emergency feedwater distribution systems, and a heat transfer surface system consisting of pipes and a steam collector.

A nuclear power plant with a pressurised water reactor (PWR) uses the steam generator as the heat exchanger between the core and secondary circuits. The heated core circuit coolant enters the hot collector from where it is distributed to the heat-exchange tube bundle. Upon the passage of the bundle, the coolant passes the heat to the feedwater and after cooling down it enters the cold collector. After that it enters the cold branch of the core circuit loop and back to the reactor. On the secondary part of the steam generator the feedwater creates the saturated steam which is transferred to the turbine.

Main coolant pump

The main coolant pump is usually a vertical rotary single-stage pump with a shaft seal unit and asynchronous electrical drive. For the required follow-up upon power supply failure it is equipped with a flywheel.

The main coolant pumps provide the circulation of the required amount of the coolant in the core in compliance with the heat power of the reactor in various operating modes.

Pressuriser system

The pressuriser system consists of the pressuriser, bubble reservoir, safety valve nodes and the tubing connecting individual devices to the follow-up systems. The pressuriser is a vertical all-welded vessel with ellipsoidal bottoms. The pressuriser assembly includes electric boilers and a sprinkling system.

The pressuriser system is used to maintain the pressure and limit the pressure variations in the core system and to protect against the uncontrolled pressure increase in the emergency modes as well as to provide the smooth increasing and decreasing of pressure during heating and after cooling of the core circuit. The pressure in the core circuit is created and maintained by heating the water part in the pressuriser or coolant injection to the steam part of the pressuriser. The safety valve node is designed to suppress the undesirable pressure increase in the core circuit during a failure of the technological equipment and safety systems.

B.I.6.3.1.1.2. Core circuit auxiliary systems

Core circuit refilling and maintaining the chemical regimes

The system of coolant refilling and withdrawal in the core system and the systems for the adjustment of the coolant chemical composition are necessary in order to provide the long-term chain reaction control and to maintain the required coolant purity.

The system primarily performs the following functions:

- it maintains the necessary coolant balance in all unit operating modes using coolant withdrawal or refilling,
- it controls the amount of boric acid in the coolant,
- it removes the fission and activation products from the coolant,
- it provides refilling of the chemicals to the coolant due to the chemical regime control (coolant pH, coolant degasification.

The control of the amount of boric acid in the coolant enables to increase the reactor operative reactivity excess required for the long-term control of the fission chain reaction.

Radioactive waste processing system

The system provides radioactive waste processing in gaseous, liquid and solid forms.

The gaseous waste is generated mainly from the continuous removal of gases generated by radiolysis in the reactor or generated as gaseous fission products from the coolant. The gaseous waste is stripped of dust and moisture on dust filters and subsequently stripped of radioactive aerosols on adsorption filters. That way they can be transferred to the solid or liquid form. The purified gases are further stored in so called fuel digestion tanks where their activity is reduced by the way of natural decay, and after verification they are released through the ventilation stack in a controlled way.

Liquid waste is mainly the result of the core circuit coolant purification. The coolant is stripped of the impurities on mechanical filters and ion exchangers and the resultant radioactive waste is subsequently concentrated in vaporisers. After treatment the majority of the coolant and a part of the chemicals are re-used in the core circuit and the rest is released to the water flow after controlled verification. The ion exchangers and concentrated vaporiser waste are transferred to the solid form using fixation to a different material (most frequently cement, bitumen or glass).

The solid waste is separated, possibly fragmented, and stored in steel barrels.

The solidified and solid waste is transferred in steel barrels to the permanent repository on the premises of the Dukovany Nuclear Power Plant.

System of cooling and cleaning the fuel pond

The system of cooling the fuel pond provides the heat removal from the spent fuel during its long-term storage in the spent fuel storage pond, during the fuel replacement as well as in the case that the entire core is removed from the reactor. The system further maintains a sufficient level for shielding the staff from the radioactive exposure from the fuel. The cleaning system ensures a sufficient quality of cooling water is maintained and consists of lines of ion exchanger filters.

Systems of environmental technology

The systems of environmental technology ensure the parameters of the environment in order to create the conditions necessary for the operating staff and for the proper functioning of the technological equipment during the operating states and emergency conditions.

B.I.6.3.1.1.3. Safety systems

Emergency core cooling system

The emergency core cooling system protects the core from heat damage. It functions as the main during LOCA (Loss of Coolant Accidents), which are accidents with the loss of coolant from the core circuit. During those accidents it provides the supply of cooling water and boron to the reactor area. The fuel replacement pond, which is located in the containment and has sufficient capacity for that purpose, is also used as the cooling water reservoir.

Residual heat removal system

The residual heat removal system removes the heat generated in the shutdown reactor as a result of radioactive transformations of fission products present in the fuel, and after-cools the reactor under the normal operating conditions, abnormal conditions and the design emergency conditions with the core circuit tightness maintained.

Safety depressurising system

The safety depressurising system is used for the controlled pressure reduction in the core circuit required for proper functioning of the core emergency cooling system.

Intermediate cooling circuits

Those are the closed cooling circuits, providing the heat removal from the core circuit systems to the service water system. These systems form the protective barrier against the penetration of radioactivity to the service water system.

Essential Service Water (ESW) System

This system provides removal of the residual heat from all important unit systems, where longer-term cooling failure is unacceptable. In the case of accidents, it removes the heat from the intermediate cooling circuits, emergency core cooling system or residual heat removal system.

Heat from the system is removed to the terminal heat collector which most often includes the cooling towers or ponds with spraying.

Steam generator emergency supply system

This system is used to provide the steam generators supply with demineralised water in the case of a failure of the main as well as backup steam generator supply. That way it provides heat removal between the core and the secondary system in the case of accidents without the loss of the core circuit coolant.

B.I.6.3.1.1.4. Containment system

The containment system consists of the inside leak-proof envelope and outside containment. The leak-proof envelope consists of the structure proper and hermetical sealing nodes (passages, bushings, closing elements) and in its inside area are the systems for the control of pressure and temperature inside the leak-proof envelope (e.g. passive heat removal, showers, hydrogen combustion etc.).

The containment system is designed so that in the case of the operating states, and under the emergency conditions related to radionuclide leakage including severe accidents, it reduces the leakage into the neighbourhood so that the radiation impacts are acceptable for the neighbourhood. The containment structure and systems are designed in order to protect the reactor vessel, core circuit and all related equipment required in terms of the nuclear and radiation safety, located in the containment against the external events, the incidence of which cannot be eliminated with sufficient probability. The containment system also provides the function of biological shielding.

B.I.6.3.1.2. Secondary part

The secondary part consists of the secondary circuit, secondary circuit auxiliary systems and the main cooling circuit.

B.I.6.3.1.2.1. Secondary circuit

The primary purpose of the secondary circuit is to deliver steam and transform its power to the mechanical power of the steam turbine rotor and to the electrical power in the generator.

Main system of steam supply (steam lines)

The purpose of the system is to supply the steam from steam generators to the high pressure part of the turbine in the extent of flow rates and pressures that include all operating modes from the system warm-up to operation at maximum capacity. The steam supply system includes the main steam lines, quick-acting isolating valves, safety valves and the follow-up steam line and piping. The main steam lines are dimensioned and run in order to provide the even pressure on the turbine inlets.

The system also contains the supply steam pipeline routes for the bypass stations to the condenser. The bypass to the condenser provides removal of a part of the steam power.

Turbo-set

The turbo-set is used to transfer the steam heat power into electric power. The turbo-set has no functions related to the unit's nuclear safety.

The steam turbine is a condenser-type with tandem arrangement and a moisture separator and reheater following the high-pressure part.

The generator is connected directly to the turbine's shaft.

The oil management for the turbine and generator is located in the machine hall. It contains a reservoir, coolers, pumps, pipelines, valves and other equipment. The equipment is secured against the leakage of oil from the system.

Main steam generator supply system

The system is intended to supply the feedwater with proper parameters to the steam generator. The feeding station includes the main feed pumps and auxiliary feed pumps (to ramp and shutdown as well as handle some transitional states of the unit) and follow-up pipeline systems and valves.

The thermic degassing takes place in the feedwater tank. The feedwater that is already at the operating pressure is heated in high-pressure regeneration (HPR) to temperatures close to boiling point and further transported via the regulating feeding head feeders to the steam generator.

On the feedwater pipeline routes to the steam generator the feeding regulation stations (the so called feeding head feeders) are installed. The feeding regulation station together with the feed pump ensures maintaining the required feedwater level in the respective steam generator.

B.I.6.3.1.2.2. Secondary circuit auxiliary systems

The auxiliary systems include the intermediate cooling circuits in the machine hall, non-essential service water (NESW) system, self-contained condensate treatment, low-pressure compressor station, self-contained heat-exchanger station etc. Some function as auxiliary systems for the whole unit, e.g. chemical water treatment plant ChWTP and demineralised water storage. The existing cooling water treatment plant (CWTP) will also be used for the new units.

Intermediate cooling circuits in the machine hall

This system is used to remove heat from the selected pumps and other equipment located in the machine hall, intermediate machine hall and in the self-contained exchanger station and it passes the heat to the non-essential service water circuit.

Non-essential Service Water (NESW) System

This system is used for the cooling of the secondary circuit devices, emergency sources of feeding inessential for nuclear safety, intermediate cooling circuit. Each unit has a separate system of NESW cooling. The NESW cooling system includes the pumping station, pipeline connections to the unit, feeding pipeline to the terminal heat collector and the terminal heat collector. The NESW system is closed, with loss replenishing water from CWTP.

Chemical Water Treatment Plant (ChWTP) and demineralised water storage

In the building of the chemical water treatment plant, the demineralised water is prepared and used as an additional feeding water of the core and secondary circuit.

Systems of environmental technology

The systems of environmental technology ensure the parameters of the environment in order to create the conditions necessary for the operating staff and for the proper functioning of the technological equipment during the operating states and emergency conditions.

B.I.6.3.1.2.3. Main cooling circuit

The system for the main cooling (circulation) circuit includes the cooling water pumping station, pipeline connection to the machine hall, cooling for the turbo-set condenser, pipeline connection to the cooling tower, the cooling tower proper, feeding channels for cooled water from the cooling towers to the pumping stations etc. The cooling water circulation circuit is closed with loss replenishing with water from CWTP. The cooling circuit surface blowdown is introduced to the inspection trap before its discharge to the receiving water.

Each nuclear unit will have a separate cooling circuit. These circuits may be interconnected both on the side of the cooled water channels and on the side of the delivery ducts from the motor hall to the cooling towers.

Cooling tower

For the heat removal from the secondary circuit of each nuclear unit, one or two Iterson-type cooling towers with natural airflow are considered depending on the power alternative of the project. The cooling towers are provided with distribution piping for heated water, spraying jets, a cooling system from plastic blocks and efficient eliminators that reduce the drift of water drops in the airflow.

B.I.6.3.2. Electrotechnical part

B.I.6.3.2.1. Description of connection to the power generation system of the Czech Republic

Two separate 400 kV outdoor lines will be used for the power output from the units to the 400 kV VHV Kočín switchyard which at present is connected to the power generation system using five 400 kV lines.

For the spare power supply for internal consumption, two outdoor 110 kV lines also from the Kočín switchyard will be used. The spare power supply for the internal consumption of units 3 and 4 will be provided with mutual backup.

The power output and power supply for internal consumption will ensure that the potential external and internal failures of electric distribution affect the operation of the reactor and the systems of heat removal as little as possible and that the equipment required for the power plant operation is powered from two independent sources (the generator proper and the power generation system grid).

B.I.6.3.2.2. Electric system

B.I.6.3.2.2.1. Operating power supply

The tap changing regulating transformers will be used as the working source of the internal consumption supply for each of the generating units. These tap changing transformers will be powered from the turbo-generator or via the block transformer from the 400 kV VHV switchyard Kočín, where the unit power will be evacuated.

B.I.6.3.2.2.2. Spare power supply

The spare regulating transformers will be used as the spare source of the internal consumption supply for each of the generating units. These transformers will be powered from the 110 kV VHV switchyard Kočín. The spare sources will be used during both the normal and abnormal operation as well as in the emergency situation in the case of a partial or full loss of the operating power supply.

B.I.6.3.2.2.3. Emergency power supply

In compliance with the basic concept of the primary part, the systems of secured power supply will be established for the power supply to the systems essential for nuclear safety. The emergency sources will include the automatically launched and connected emergency sources of power supply and/or accumulator batteries and uninterrupted power supply systems. For the equipment unessential for nuclear safety, but essential for the protection of people or protection of investments, an independent power supply using automatically launched and connected emergency power supply sources will be provided.

B.I.6.3.3. Control and Management System (CMS)

B.I.6.3.3.1 CMS general requirements

The control and management systems together with the other power plant systems contribute to a good performance level in terms of power generation while maintaining the high safety level in terms of the capability to face abnormal operation and emergency conditions.

The commercially available digital technologies will have priority use in the implementation of the control and management systems for the new equipment. Depending on the specific supplier, the equipment combining digital and analogue technologies or the analogue technologies only may also be used depending on the control philosophy.

The high level of automation will be functionally used, mainly for the reason of minimising human factor faults and limiting their potential impacts.

Only the tried and tested equipment will be used, while incorporating the experience from already operated applications.

The information and control systems will be equipped in order to provide monitoring, measurement, recording and handling of the operating parameters essential for securing nuclear safety during normal and abnormal operation and under emergency conditions.

Communication and control devices will be designed and located in order to continuously provide sufficient information to the operating staff and to enable operative intervention if needed.

The control and information systems will provide visual and audio warnings informing of the operating states and processes that deviate from the admissible limits for the normal operation and may affect nuclear safety.

The control and information systems will record, continuously in regular intervals, or as needed, the values of the parameters that are necessary for nuclear safety in accordance with safety analyses.

In the case of the emergency conditions, the instrumentation shall provide:

- information regarding the current state of the nuclear plant, based on which the protective measures can be carried out,
- basic information on the course of the accident and its recordings,
- the information that enables the prognosis and characterisation of the spread of radionuclides and radiation to the neighbourhood of the nuclear power plant so that it is possible to implement timely measures for the protection of the population.

In accordance with the current requirements, the designed units will also be provided with equipment for the monitoring of parameters in the case of diminishingly probable severe accidents connected with the fuel melting.

B.I.6.3.3.2. Protective systems

The nuclear plants consisting of a nuclear reactor will be equipped with protective systems that will be:

- capable of identifying the abnormal conditions and automatically start the respective systems in order to ensure that the design limits are not exceeded,
- capable of identifying the emergency conditions and start the respective systems designed to alleviate the impacts of such conditions,
- subordinate to the operation of the control systems and the nuclear power plant operating staff, in all states considered in the nuclear power plant design, while the operating staff must have the possibility to launch the protective system manually.

The protective and control systems will be separated so that a fault of the control systems does not affect the capability of the protective systems to perform the required safety function. The functionally necessary and practical connection of the protective and control systems will be limited as much as possible so that it does not have a significant effect on nuclear safety.

The protective systems will be designed with a high functional reliability, backup and independence of individual channels so that no simple failure might cause the loss of the protective function of the system.

In order to reduce the impact of a common cause failure in the digital systems, application of functional diversity (detection of the abnormal state using various parameters and events), and instrumentation, will be used.

B.I.6.3.3.3. Human-machine interface

For the operational control of the new plants, modern human-machine interfaces will be used in order to enable the power plant operating staff to react in a timely and correct manner to all states of nuclear equipment and power plant systems.

One type of the human-machine interface will be used for control during all power plant states. An exception may include cases when the control requires backup devices due to safety or emergency reasons. In such case the advantage of the diversity of various human-machine interface types must be used.

In order to support the staff in decision-making, the appropriately arranged information will be available in order to provide staff with an immediate overview of the situation of the entire unit for safe and effective control.

The information regarding the operation and signalling of the operating situation, or abnormal state incurred, will be arranged so that the staff load is minimised.

In order to handle emergency conditions, enough means for the control will be available, redundant and diverse in the respective way, both in the unit control room, and in another respective place of control.

B.I.6.4. Structural design data

B.I.6.4.1. Design parameters of structures

The design concept for supporting building structures is based mainly on the design of technology and loading effects as a result of operating and emergency conditions; the conditions of the location are another determining factor. The engineering and geological conditions of the location and external extreme effects, that can be divided into effects of natural origin and external effects caused by human activity, are decisive for the type of technical design of the main building structures.

In our conditions, the natural effects include the extreme climatic effects, seismic effects and floods. The extreme effects resulting from human activity include e.g., the accidents on transport routes, accidents of industrial plants, aircraft crashes, outside explosions, fires etc.

The type of design for supporting structures is set by the general guidelines in accordance with the legislation of the Czech Republic for nuclear plants. That is Act no. 18/1997 Coll., as amended, and the following decrees of the State Office for Nuclear Safety which include the basic criteria for the location of nuclear power plants, requirements for the provision of nuclear safety, quality and technical safety of buildings and structures.

B.I.6.4.1.1. Buildings and structures significant for nuclear safety

The requirements for the design of the supporting building structure and acceptance criteria for the response to the specified load are in the case of the nuclear plants defined based on the so called safety classification of structures, systems and components. That means that the buildings and structures that fulfil some of the safety functions will be clearly identified within the project and the acceptance criteria for the analyses of individual and loading effects will be defined. The conceptual design of supporting structures of buildings will meet their level of classification and respect the basic international MAAE recommendations for the evaluation of the threat by both external and internal impacts and the rules for deriving the design loading parameters.

B.I.6.4.1.2. Buildings and structures insignificant for nuclear safety

The design of buildings classified as insignificant for nuclear safety will be prepared in accordance with the general technical standards applicable for common buildings.

B.I.6.4.2. Urban and architectural design

B.I.6.4.2.1. Urban design

The urban concept of the NPP Temelín premises will comply with the approved territorial plan. The designed siting, technical and layout design of the NNPP structures in the area of the northwestern boundary of the premises shall respect the location of the existing operated structures of NPP Temelín 1, 2. The cooling towers will be located in order to provide a balanced view of the premises from other places in terms of dimensions.

B.I.6.4.2.2. Architectural design

The architectural design follows the principles of the existing NPP Temelín premises and it will develop them in a modern way. A study for the colour design of the structures that will specify the architectural design also with respect to the existing NPP Temelín 1, 2 will be prepared in the following proceedings.

The spatial design of new structures will be prepared with respect to the existing built-up area and the final general view of the power-producing structure.

The building structures have to conform to technological needs and depending on the requirements they are resistant to external effects and external climatic conditions. The buildings have to conform to the common operation as well as extraordinary events, provide maximum comfort and, if needed, also protection to both operating and maintenance staff.

B.I.6.4.3. Foundations of structures

For the construction of new units in the location of NPP Temelín, all legislative requirements are met, mainly the criteria of the SONS Decree no. 215/1997 Coll., on criteria for siting nuclear installations and very significant ionising radiation sources, as amended. Also all excluding and conditional criteria applying to the geology, hydrogeology and seismology are met. The selection of the location complies with the international MAAE recommendations.

For the assessment of foundation soils and the design of foundation structures the national technical standards and regulations applicable at the time of project preparation can be used. For the structures significant for nuclear safety, the requirements of MAAE regulations will further be considered, mainly the acceptance design criteria following from the safety classification.

The location was examined in the 1980s within the site preparation that had been prepared for the construction of four units from the beginning. Several stages of drill-hole exploration, field and laboratory tests of rocks took place. Within rough grading almost all layers of the quaternary blanket and weathering foundation rock were removed in the central part of the construction site. The layers 5 to 10 m thick were drawn at the construction site; the footing bottom of all safety-significant structures will be on the level of very resistant weathered bedrock or semi-rock, including the new units. For the NNPP location the engineering and geological, as well as geotechnical analyses, will be updated.

The shallow foundation (slab foundation or footing) will be used for all critical structures; exceptionally it will be necessary to use the pile foundation at the peripheral parts of the construction site.

B.I.6.4.4. Description of critical structures

The description specifies the structures that will be newly built except those where it is explicitly specified that they are the structures of the existing power plant with a joint use for the NNPP.

The description below may differ from the final design; it is the description of a common structural composition of the nuclear power plant with a pressurised water reactor with the specified power alternatives. The arrangement of the equipment in the structures may also differ from the final project design.

B.I.6.4.4.1. Reactor building

The reactor building consists of the structural part of the containment system, possibly also of the enclosure.

The reactor building houses the main equipment of the primary part - the core circuit, selected parts of the safety and auxiliary systems.

Its main function is to protect the environment from the impacts of accidents and to protect the main equipment of the primary part from the external effects described above in chapters B.I.6.1.4.5.3. External natural effects and B.I.6.1.4.5.4. External effects resulting from human activity (e.g. earthquake, aircraft crash etc.).

B.I.6.4.4.2. Safety systems building

In the case that the safety systems (described above in Chapter B.I.6.3.1.1.3. Safety systems) as a whole are not located in the reactor building, the safety systems buildings are designed separately and adjoin the reactor building directly.

B.I.6.4.4.3. Active auxiliary operations building

The active auxiliary operations building is usually linked to the reactor building directly, possibly it is interconnected to the reactor building using technological and transport bridges and transport corridors.

In the active auxiliary operations building there is usually the radioactive media cleaning system including laboratories, the area of active workshops used for the maintenance of polluted equipment, fresh fuel storage (if it is not included in the fuel building) and the main entrance to the controlled area with respective equipment for the staff.

B.I.6.4.4.4. Fuel building

The fuel building usually continues the reactor building directly. They are connected via the fuel transport channel.

A part of the spent fuel is usually located outside the containment in the so called fuel building. This building may also contain the equipment of the active auxiliary operations building (especially the fresh fuel storage).

B.I.6.4.4.5. Entrance building

The entrance building is used for the entrance of the staff to the main structures of the primary and secondary part. In terms of the primary part it mainly provides the entrance to the controlled area, if this service is not provided in the active auxiliary operations building.

B.I.6.4.4.6. Radioactive waste processing building

If the solidification technology is not located in the active auxiliary operations building, the power plant is provided with a separate radioactive waste processing building which is located at the auxiliary operations building and interconnected with it in terms of the technology.

B.I.6.4.4.7. Essential Service Water (ESW) cooling system structures

The structures and respective equipment are used for the heat removal from the circuit of essential service water into the atmosphere. They have a design of cooling towers with forced draft, or cooling in the ponds with spraying, like in the case of the existing power plant.

If the pumping stations are not a part of the emergency power supply structures, they are located in separate buildings.

B.I.6.4.4.8. Structures of emergency power supply for the equipment significant for nuclear safety

The structures of emergency supply for the equipment significant for nuclear safety are used for the location of the sources of emergency alternating power supply. In each of these structures, one essential service water pumping station and high-pressure compressor station can be located.

The main technological equipment usually includes diesel-generator units or internal-combustion turbines with all necessary support systems and fuel management, which provide a self-standing source of power for the equipment essential for nuclear safety, and is launched in case that the working as well as spare power supply is lost.

B.I.6.4.4.9. Machine hall

The machine hall contains the main equipment of the secondary part, especially the turbo-sets, condensers, condensate and feeding pumps, feed tank and heat exchangers of the regeneration system, and a self-contained heat-exchanger station (if it is not a separate structure).

The main interconnection of this building with the reactor building or with the safety systems building includes the steam line and the feedwater line.

The turbo-set accessories mainly include the hydrogen and sealing oil management, and the management of gases and cooling water for the generator.

B.I.6.4.4.10. Non-Essential Service Water (ESW) cooling system structures

The structures of pumping stations and respective equipment are used for the heat removal from the circuit of non-essential service water into the atmosphere.

The system may be forced with the use of forced draft cooling towers. The number of cells and the size of the cooling tower will depend on the size of the unit, possibly the cooling towers of the main circulation cooling circuit may be used for heat removal.

B.I.6.4.4.11. Structures of emergency power supply for the equipment insignificant for nuclear safety

The structures of emergency supply for the equipment insignificant for nuclear safety are used for the location of the sources of emergency alternating power supply.

The main technological equipment includes diesel-generator units or internal-combustion turbines with all necessary support systems and fuel management that provide a self-standing source of power for the equipment insignificant for nuclear safety, but significant for the protection of persons or protection of investments, and are launched in case that the working as well as spare power supply is lost.

B.I.6.4.4.12. Compressor station and cool source station

The compressor station is used for the delivery of low-pressure compressed dry air for the purposes of maintenance, containment tightness and strength tests and valve control.

The cool source station is used for the delivery of low-temperature water mainly for the purposes of air-conditioning and ventilation.

B.I.6.4.4.13. Main cooling circuit pumping station

The main cooling circuit pumping station is usually designed as a separate structure in the area between the machine hall and cooling towers at the end of the inlet channels of cooled water from the cooling towers.

It contains the pumps of the main cooling circuit, possibly the pumps of non-essential service water or fire water, if they are not located in separate structures.

B.I.6.4.4.14. Main cooling circuit cooling towers

The cooling towers of the main cooling circuit are used for the removal of heat from the secondary circuit condenser into the atmosphere.

For the Temelín location one or two cooling towers per unit are considered depending on the power alternative of the project, i.e. up to four new Iterson-type towers. These towers use the natural airflow in the tower body for heat removal.

B.I.6.4.4.15. Power substation

It is the structure adjoining the machine hall, which usually houses the electrical distributing equipment, the control and management system equipment and the environmental technology equipment for the needs of the unit.

B.I.6.4.4.16. Power output and spare power supply

The power output means a 400 kV line that is installed between the block transformers and the Kočín switchyard. This line supplies the generated power to the power grid or the power is used for the working power supply for internal consumption. The current 400 kV two block lines will be completed with two new block lines (one per each new unit).

The spare power supply means a 110 kV line that is installed between the spare transformers and Kočín switchyard. This line is used to provide the spare power supply for the internal power plant consumption. The current routes with two 110 kV lines will also be partially used for the new spare power supply.

B.I.6.4.4.17. Cooling Water Treatment Plant (CWTP) - decarbonisation

It is the currently operated structure, which is expected to be used for the existing as well as new units. The technology located in this building is used for the treatment of raw water to the parameters required for use in the main cooling circuit and other power plant systems. Thus the structure also includes the chemical stores and laboratories.

For the project design the structure will be completed with proper equipment.

B.I.6.4.4.18. Chemical Water Treatment Plant (ChWTP) - demineralised water storage

It is the structure that houses the equipment for the preparation and storage of demineralised water for power plant systems where its quality is required.

The storage reservoirs for demineralised water will be located outside the treatment plant.

The structure will also include the chemical stores and laboratories.

The treated water designed for demineralisation will be transported from the existing cooling water treatment plant - decarbonisation.

B.I.6.4.4.19. Auxiliary structures

Technical gas management, chemical store, central management for oil and lubricating oil are used as the stores for the operating media required for the operation of various power plant systems.

B.I.6.4.4.20. Workshops

In the structure of workshops, the maintenance operations and equipment stores including the associated background for staff or suppliers will be located. It may further house the garages for the maintenance motor vehicles.

B.I.6.4.4.21. Operations building

The operations building is used as the background for the operating staff; it contains the offices, sanitary facilities, often also the dining facilities, laboratories etc.

It is located in the vicinity of units and it is connected with the use of transport bridges.

B.I.6.4.4.22. Water conduits and sewerage

On the premises of the new nuclear power plant the new sewer and water conduits will be built, mainly connected to the existing outdoor distribution systems on the existing Temelín Power Plant premises.

The existing water main to the power plant from Zdoba water reservoir will remain the source of drinking water.

In the area of sewerage collection, three main sewerage networks will be built, storm sewers, sanitary sewers and industrial sewers.

The storm sewers will be of the gravity type and they will be used for the removal of unsoaked rainfall water from the roofs of buildings, hard and soft surfaces. The resulting main sewers from the NNPP area will be connected to the existing main sewers on the Temelín Power Plant premises. As a result the rainwater from the NNPP premises will be removed together with the rainwater from the existing NPP Temelín premises using a resulting sewer DN 2200 (1600) to the safety reservoirs Býšov and further also via the existing Býšov retention reservoir to the Strouha stream with the terminal mouth to the Hněvkovice reservoir on the Vltava River.

The sanitary sewers will be treated in the modernised existing waste-water treatment plant, with the capacity that will fully conform to the disposal of raw sewage from the operation of both NPP Temelín and the NNPP.

The industrial sewerage system will be used for the collection and removal of industrial waste water, mainly the blowdown from the main cooling circuit and waste water from waste water treatment plants and neutralisation and oiled water. Oiled waste water will be conducted to the oil separators and, after treatment, used preferentially as additional water to the main cooling circuit. Waste water from the main cooling circuit, waste water treatment plants and from neutralisation will be removed to the new examination trap that will be built next to the existing examination trap. The treated soil water from the reconstructed water treatment plant will be removed as before to the existing examination trap that is located in the immediate vicinity of the waste water treatment plant.

After radiochemical inspection, the water from the examination traps will be released using the existing currently used waste water lines for the purposes of the Temelín Power Plant, into the Vltava - Kořensko segment. The lines were designed for the requirements of four units and they have sufficient spare capacity for the NNPP.

B.I.6.4.4.23. Other utilities

The main routes of power supply and data cabling will be located in the cable ducts connected to the lower structure of individual buildings.

External pipeline routes of technological media (steam, water) will be designed in technological ducts, possibly using the pipeline bridges.

At the same time, a new main power plant earthing network will be built and subsequently connected to the existing main earthing network.

B.I.6.4.4.24. Roads and hard surfaces

The road network providing the transport services for the individual building structures will be built on the NNPP premises. The roads may be extended to utility areas in the vicinity of structures

After the end of construction, the constructed road network will be connected to the existing road network on the Temelín Power Plant premises.

B.I.6.4.4.25. Railway siding

Temelín Power Plant is connected to the railway network using the siding track running from the Temelín railway station which is located on track 192 Číčenice - Týn nad Vltavou. The siding is terminated at the northeastern boundary of the area with a transfer track point. In case of future increased transport requirements, it is possible to expand this track point with other handling tracks.

B.I.6.4.4.26. Fencing

The NNPP project will define the physical protection system for the NNPP, which will be connected to the existing physical protection system of the Temelín Power Plant. Besides, the NNPP will be fenced during the construction; the fencing will continue the existing fencing of the units under operation and so the entire NPP Temelín premises will be fenced.

Fencing is equipped with a CCTV system including self-contained lighting, motion detection in the corridor area and a safeguard of all gates in sidings and roads.

B.I.6.4.4.27. Terrain modifications and reclamation

The rough grading will be performed before the start of the NNPP premises construction including their excavations as well as after the end of their construction which will be carried out as a part of technical reclamations.

The terrain modifications will include topsoil removal and depositing at the secured topsoil deposit and possible removal of vegetation (felling and clearing).

Classification of reclamation works after the end of construction:

- technical reclamation - it will include approximately the following: demolition of temporary structures/equipment on the construction area and on the area of site facilities, rough grading including the spreading of the topsoil upper layer,
- biological reclamation - it will be performed after the end of technical reclamation; it includes biological and agricultural modifications of the topsoil upper layer.

B.I.6.4.4.28. Landscaping

On the premises of the new nuclear power plant, the biological reclamation will be performed on soft surfaces between the roads and ground structures. It will include foundation of lawns, tree and bush planting. The planting will be designed both in groups in dense planting and as lone trees. The landscaping will create the proper industrial complex environment and partly protect against unfavourable noise and dustiness.

At the same time these modifications will be used to incorporate the new power plant premises to the surrounding countryside including the existing power plant premises.

B.I.6.4.4.29. Spent nuclear fuel repository

The structure is not a part of the project, however, its construction is expected after approximately 10 years of NNPP operation. It will be used as a storage facility for cladding sets with spent fuel.

The location and building design of the repository will be dealt with later; in the NPP Temelín area there is sufficient spare space for its location. Its preparation will also include the environmental impact assessment:

B.I.6.5. Operational design data

B.I.6.5.1. Water supply

Water supply to NPP Temelín, possibly the NPP Temelín water systems, includes the following systems:

- raw water system - provides replenishment of water to the circuits of circulating cooling water, ESW, NESW, and water for the ChWTP requirements,
- circulation cooling water system - provides heat removal from the secondary circuit from the TG condenser,
- essential service water (ESW) system - provides heat removal from the devices of the intermediate circuit in the reactor hall,
- non-essential service water (NESW) system - provides cooling of the devices in the secondary circuit of the unit, possibly in the reactor hall,
- drinking and sanitary water system,
- fire water system.

B.I.6.5.1.1. Raw water

Raw water that will be used for the replenishment of cooling circuits, and for the ChWTP needs after passage through the CWTP, will be provided from the existing raw water supply system. This system includes the Hněvkovice raw water pumping station (PS), 2xDN1600 supply mains to NPP Temelín and 2x15000 m^3 water reservoirs.

The increase in the need of raw water will be satisfied by a higher number of operated pumps than the maximum 2 operated pumps at present.

In order to provide raw water to the NNPP, it will be necessary to operate up to 3 to 4 pumps to 2 force mains. In the case of units with higher power than 2x1200 MW_e the parameters of the existing pumps (delivery head) will have to be adjusted.

B.I.6.5.1.2. Fire water

In order to provide fire water for the NNPP external areas and for the structures that do not belong to category 1 of seismic resistance, 2 separate pumping stations for fire water will be built. The PSs will be located by each circulation cooling water PS, the supply of fire water for fire extinguishing will be satisfied by connecting to the cooling circuit (inlet channels to PS). In each fire PS the fire pumps and automatic pressure station for maintaining the pressure in the fire line will be installed.

Power supply to the pumps and other equipment is carried out from 2 independent sources, one of them being the diesel-generator station of the secondary circuit.

B.I.6.5.1.3. Drinking water

The drinking water distribution system on the NPP Temelín premises is connected to the Zdoba water line using two DN 400 water mains. The capacity of this design is also suitable for the planned expansion of the NPP Temelín premises with two new units.

B.I.6.5.2. Inactive waste management

The composition of wastes generated during the operation and maintenance of NNPP technological equipment can be expected to be identical to the existing state of NPP Temelín. Waste disposal will be carried out in accordance with the act on wastes and with the management documents of ČEZ, a. s. Waste management will be based on the existing management system. The respective wastes will be collected at the previously specified collecting points and subsequently handed for final disposal to specialised companies authorised to handle wastes, or to the own waste dump in location 6 - Temelínec. Maximum effort will be paid to reduction of waste dumping and use of waste as secondary raw material.

The inactive wastes also include the inactive wastes generated in the controlled area of the nuclear power plant. Upon inactivity confirmation using dosimetric control, the waste is removed from the controlled area and it is further handled in accordance with the act on wastes.

The hazardous waste generated during NNPP operation will be handled in accordance with the applicable regulations, it will be handed over to the person authorised to their acceptance and disposal.

At the time of NNPP construction, approximately 98% of the generated waste will be of building nature. The majority group will include inert materials that will be preferentially recycled and used as a secondary raw material. That will be used at the NNPP construction site, in production of subconcrete, in the road base courses, for filling non-structural concrete (non-technological structures), for fills and subbases of utilities, hardening and modifications of surfaces, for areas and structures of site equipment etc. (all in compliance with Decree no. 294/2005 Coll., as amended, Act no. 22/1997 Coll., as amended and other related regulations). For the recycling of building waste, the use of mobile recycling line, located in the area of site equipment, is considered. The excess of this secondary building material will be sold in the places where it can be used as building material, possibly for cleaning up (MAPE) etc. The unusable remaining waste may be deposited to the dump at the existing Temelínec location. Therefore expansion of the existing S-IO Temelínec dump is planned as well as the extension of its operation for further needs of both the existing NPP Temelín and NNPP.

B.I.6.5.3. Radioactive waste management

In accordance with the Nuclear Act, radioactive waste (RAW) is defined as “substances, objects or facilities containing or contaminated with radionuclides, the continued use of which is not assumed”. In accordance with Decree no. 307/2002 Coll., on radiation protection, RAW is divided into gaseous, liquid and solid. Solid RAW is classified into three basic categories, specifically to transitional, low- and medium-level and high-level waste.

The RAW management system manages the collection, separation, processing and treatment of all types of wastes that are generated in the controlled area. The RAW processing system also provides for the handling of wastes and their release to the environment (if they meet the conditions) and to RAWR.

The RAW processing systems will be equipped with modern technologies providing the maximum reduction of waste to be reposed possible, providing the suitable physical characteristics of the substances released into the environment, as well as the minimum radiation dose to the staff. In order to be minimised, the wastes will be separated at the point of origin depending on their activity to the active, and potentially inactive waste. The generated waste will further be separated based on the expected way of processing and treatment. The active waste will be processed using the installed technological systems. These systems will have sufficient processing as well as storage capacity. During the whole RAW management process (processing, storage, final treatment of RAW) the monitoring of characteristic values will be ensured.

Processing of contaminated liquid media is a result of the effort to concentrate the activity to the least volume possible. That way, the relatively small amount of the medium that can be labelled as RAW is generated on one hand, and on the other hand a relatively large amount of decontaminated medium for further use. The methods for processing and final treatment of radioactive water will include the tried methods, like filtration, centrifugation, vaporisation, drying and fixation to a matrix.

When processing gaseous RAW, the radioactive substances will be separated from contaminated air mass using filtration. The systems will be equipped in order to prevent the leakage of radionuclides into the environment (retardant absorbers, active filters, equalising tanks). When processing solid waste, the tried methods including separation, fragmentation, pressing, will be used. During pressing, the volume of RAW that is to be reposed, is again minimised.

After the final treatment, the treated short-term low-level and intermediate-level RAW is removed to the repository in Dukovany. The repository is designed not only for the reposition of the operating waste, but also the waste from the period of decommissioning.

High-level waste that cannot be reposed in the Dukovany repository, is stored in an organised way in the storage facilities of the power plant.

B.I.6.5.4. Spent fuel management

The spent (possibly irradiated) nuclear fuel (SNF) is removed from the reactor core to the spent fuel storage pond where it is stored for the time necessary to reduce the power of the residual heat. The size of the pond meets the requirements for storage of spent nuclear fuel for 10 years, while it provides a free space for the full evacuation of the reactor core during the whole designated time. In the pond, the fuel is stored under the sufficient layer of water with the content of boric acid. After the period of time necessary for the reduction of the power of the residual heat, the SNF is transferred to special package sets and moved to the spent nuclear fuel repository on the power plant premises.

All SNF that will be generated during the operation of all NPP Temelín units (including NNPP) will be handled on the NPP Temelín premises where its storage will also be provided. It will be transported to the deep repository after it is declared radioactive waste. The long-term storage and following reposition of SNF in the deep repository is considered the basic national strategy in the spent nuclear fuel management in accordance with the “Policy of Radioactive Waste Management and Spent Fuel Management”.

B.I.6.5.5. Fresh fuel management

The fresh fuel is located in the fresh fuel storage facility, which is designed in order to provide for the protection of the fuel against natural impacts, earthquakes and other unfavourable effects. The fresh fuel storage facility includes the equipment for the necessary handling of the fuel, i.e. reception of fresh fuel, its inspection and storage before loading into the reactor.

B.I.6.5.6. Radioactive inventory data

The spent nuclear fuel is the most important item of the radioactive inventory on the NPP Temelín premises. During the expected 60 years of NPP Temelín 1, 2 operation and at least the required 60 years of NPP Temelín 3 ,4,operation, 5,638.5 to 7,843.5 tonnes of spent nuclear fuel (UO_2) will be gradually reposed in the SNFR.

Irradiated nuclear fuel will be present in various degrees of burn-up in all operated reactors in an amount that depends on both the reactor power and on the characteristics of the fuel used in the reactor. In the period of the simultaneous use of all 4 units in the location, the total weight of the irradiated fuel will range between approximately 358 and 498 tonnes in all four reactor cores.

The fresh nuclear fuel will be stored in the amount considering the need of the nearest regular unit shutdowns for the replacement of the fuel based on the operated fuel cycle, possibly the required spare amount depending on the current situation in the market. In general it can be expected that during the year, the fresh fuel stock will range between approximately 89.5 to 124.5 tonnes (1 reloading for all units). If the smooth deliveries are guaranteed sufficiently by contracts, the operating stock need not be maintained; the delivery of the fuel will take place only several weeks before the shutdown date and the storage facility will contain approximately between 21.75 and 39.25 tonnes of fuel max. (1 reloading for one unit) in this period right before the planned replacement.

In addition to the fuel, the power plant premises will also contain other radioactive materials. They include the following items:

- primary and secondary neutron sources (components for the reactor core) with the activity in order of 10^8 to 10^9 n/s in the total amount of approximately 10 to 15 pieces max.,
- caesium emitters of the category “significant ionising radiation source” (calibration of dosimetrical devices) with the activities ^{137}Cs approximately 1 to 65 TBq in the amount of approximately 2 pieces,
- sources of ionising radiation from the categories of “insignificant”, “minor” and “simple” (closed emitters used e.g. in the ionising fire alarms, various meters and analysers) in the number of approximately 400 pieces max.

Besides, the radioactive wastes for which the Dukovany repository is not suitable will be stored on the premises, and therefore they will be reposed into the deep repository after the end of the operation during the stage of power plant decommissioning. This applies to the following total amount for the expected 60 years of the NPP Temelín 1, 2 operation and at least the required 60 years of NNPP operation:

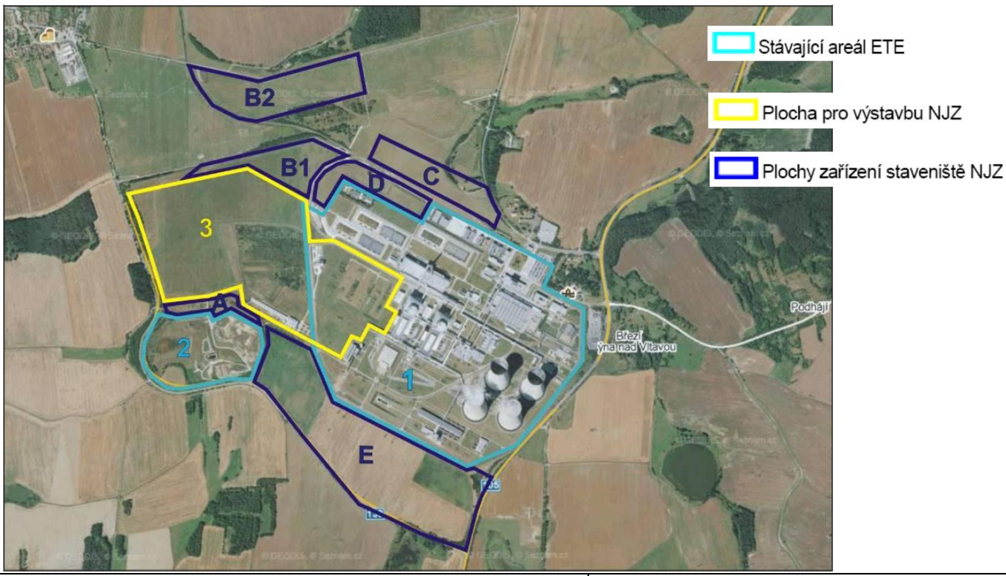
- various types of sensors, thermocouples, cassettes with witness samples and similar material, which are activated in the reactor by the way of neutron flow and are regularly replaced during the operation - approximately 15 to 20 tonnes,
- solidified used ion-exchanger filter cartridges with the total activity of approximately 10 to 30 TBq (the prevailing contaminant ^{137}Cs).

B.I.6.6. Construction data

B.I.6.6.1. Areas for construction

The construction site is divided into the construction area for the new nuclear power plant and the construction area for site facilities. The working strips for the construction of the electric power output to the Kočín switchyard, possibly the new raw water supply capacity from the Hněvkovice pumping station, are considered separately. The layout of the areas is obvious from the following figure.

Figure B.I.36: Division of construction areas



Stávající areál ETE	Existing NPP complex
Plocha prom výstavbu NJZ	Land for NNPP construction
Plochy zařízení staveniště NJZ	Land for NNPP site facilities

Area 1 includes the existing premises of NNP Temelín, area 2 is used for the power plant storage management, area 3 is the necessary NNPP construction area, areas A - E will be used for NNPP site facilities.

B.I.6.6.2. NNPP construction

The main construction stages will be as follows:

- preparatory works on construction site,
- construction works,
- installation of mechanical systems and equipment,
- installation of electric systems and APCS,
- tests.

Preparatory works on the construction site are designed as a set of individual investments creating the conditions for the construction of two new units. These investments provide e.g. determining the construction site area, supplying the fuel and energies and creating the set of technological (especially the data as well as other) links between the NNPP and operated units of NPP Temelín 1, 2. They also include the preparatory works of the NNPP contractor, consisting mainly in the preparation and implementation of the necessary site facilities.

The preparatory works of the general contractor will start with the construction of site facilities and contractor preparation on the main site, which should also include excavations for the generating unit at the NNPP construction site.

The two nuclear power plant units will be constructed with a time shift between them, given by the optimum utilisation of workforce, crane technology, successive delivery of technological parts depending on the production economy and last but not least by the successive launch given by the technical limits and the possibilities to gradually utilise the highly skilled professions.

At the beginning of the construction the interval between the matching work on unit 3 and 4 will be given by the duration of individual partial activities (excavation, foundation slab construction); during the launching stage the interval will be basically given by the duration of the launching process for the respective generating unit. The interval between the matching launch activities, starting from the cold tests and ending with the power launch of the unit, is expected to be at least 12 months.

It is expected that the tower cranes will be used as well as one heavy crawler crane, possibly an anchored crane with a substantial balance box, for the heaviest lifting of prefabricated building and technological structures.

The NNPP construction proper will start from the treatment of the foundation base, which will be followed by the armouring and concreting of the generating unit foundation slab. The building structures above the foundation slabs will be designed partly as monolithic, mainly with reinforcement fit in the blocks prepared outside the main construction site, and partly as modules of main structures with steel lining, possibly the concrete shell used for formwork. The scope and composition of individual structures will depend on the building contractor. The main generating unit will integrate the critical auxiliary operations.

During the construction works, the built-in technological parts and the elements that cannot be installed into the finished structure for dimensional reasons and the elements fixed with concrete, will be installed. The installation of a polar crane is expected before the closing of the hermetic part of the reactor unit and the successive installation of machinery after the end of construction readiness. The installation of electric equipment and control and management systems will follow. Installation work will end by individual tests of the equipment and successive tests of individual subsystems and verification of their readiness for the launch of the unit. Further activities will be aimed on the verification of design functions during the successive launch of non-nuclear as well as nuclear equipment in individual power levels up to the full design power.

The construction of the secondary part will be performed successively after the construction of the primary part, in order to provide the readiness of the turbine for the power launch of the unit in compliance with the schedule. Due to the existing operation of units 1 and 2 it will be possible to provide a sufficient amount of extraneous steam for the turbine tests, before the launch of the NNPP reactor, and to create favourable conditions for the launch.

Figure B.I.37: Construction of an EPR unit at Olkiluoto, Finland

B.I.6.6.3. Construction of power output and raw water supply

The construction of overhead electric lines will be performed in the corridor where a number of lines between the Temelín Power Plant and Kočín switchyard are already located at present. The construction will consist of concreting the foundations for individual poles, construction of poles and wiring. Along the whole length of the line, the movement of machinery will be provided (temporary working belt); after the end of works, the terrain will be modified and recovered.

The potential increasing of raw water supply capacity will be provided by adding another pipeline parallel with the existing route. The implementation will require the appropriation of a working strip approximately 20 m wide along the whole length of the pipeline. Temporary soil depositing and a travelling strip along the whole pipeline length for the construction machinery will be required. After the fill, the excess soil will be transported to the NPP Temelín soil deposit.

In both cases the construction will take 1 year max.

B.I.6.7. Shutdown data

B.I.6.7.1. Shutdown

In accordance with Decree no. 185/2003 Coll., on decommissioning of a nuclear installation or workplaces of category III or IV, as amended, the shutdown is the sum of activities aimed to the termination of use of a nuclear plant or workplace or its use for other activities than those for which the permit to operate was issued. Based on this decree, the shutdown will be included into the decommissioning process as a separate stage. The issue of decommissioning will be dealt with and refined during the whole process of preparation, implementation, launch and operation of new units in the documentation submitted for the issuance of respective permits.

Upon the shutdown, all requirements of the affected implementing regulations for the Nuclear Act will be respected. At present, these regulations mainly include the Decree no. 185/2003 Coll. and Decree no. 307/2002 Coll., as amended.

The draft policy for safe shutdown which will be a part of the documentation submitted to the State Office for Nuclear Safety with the application for the decision on the location of new units which are the subject matter of the project, will be the first draft document to solve this issue in the order. In the process of construction it will be further developed and refined on following stages. The proposal will be based on the current knowledge of technologies and procedures and on the current applicable legislation. During the following years the technical equipment will certainly be developed and the experience from the decommissioning of units of generation I and II will also be evaluated. It will be possible to apply this knowledge on the next levels of the documentation and their updates, performed in accordance with the legal regulations.

Certain aspects providing safe shutdown and decommissioning will be considered already from the start of the project preparation process of construction, when the technological procedures, equipment, materials and process layout have to be planned in order to facilitate the whole process after the final reactor shutdown.

For the future decommissioning process the following main principles applied in the design of nuclear plants are significant:

- minimising areas that may be contaminated, i.e. minimising decontamination activities during the decommissioning,
- selection of materials resistant to contamination and easily decontaminatable,
- selection of technologies that do not result in accumulation of hazardous and radioactive substances,
- selection of technologies that will facilitate the disassembly of contaminated equipment,
- viability of future management of the radioactive waste from decommissioning (processing, storage, transport, reposition),
- for heavily contaminated areas providing the decontamination using remote handling.

In order to process the required documentation for the decommissioning process, it is important to introduce a system of project archiving as well as operating documentation in order to provide, even in a very long time interval, the operating history summary for individual equipment and systems and to sort out the data required for design of the optimum solution in terms of both technology and safety.

B.I.6.7.2. Main activities and procedures during shutdown

The shutdown is the first stage of decommissioning when the reactor is shut down and the fuel is removed to the storage pond. In terms of time it is defined as the period when the spent fuel remains in the ponds for the required time. The main activities expected on this stage are as follows:

- reactor shutdown and inspection of the state of the entire equipment,
- storage of the spent nuclear fuel in the unit's pond and after its cooling, in order to provide further handling, its continuous removal to the repository on the power plant premises,
- drainage and drying of all unoperated systems,
- sampling in order to specify the radioactivity inventory after the end of the reactor operation, shutdown and drained and dried systems,
- removal of liquids from the systems,
- core circuit decontamination in order to reduce dose rates,
- processing and treatment of wastes from decontamination,
- disposal of hazardous materials and wastes,
- processing and treatment of unnecessary ion exchangers,
- processing and treatment of other operating wastes,
- monitoring of ionising radiation,
- preparation of the programme of staff radiation protection against ionising radiation for the next stage,
- providing physical protection of the premises,
- providing emergency preparedness,
- isolation of further operated equipment,
- disassembly and removal of the equipment and other inventory meeting the requirements for release into the environment,
- provision of basic equipment and materials for the needs of decommissioning activities.

On the shutdown stage the disassembly and demolition of unnecessary equipment and structures outside the primary part will be carried out. The activities will be performed as required and in accordance with operator's plan of works with respect to the use of installations and workforce.

For this period all premises relations that were provided during the operation will be provided. They mainly include the following:

- utilities (pipeline, cable, transport, telecommunication all),
- water supply (drinking, fire, technical, demineralised all),
- provision of electric power,
- supply of heat, cool, heating steam and pressure air,
- storage of chemicals and preparation of solutions,
- collection, treatment, inspection and discharge of waste water,
- spent fuel storage,
- technology for processing and treatment of RAW,
- administrative structures of the premises.

In the structures directly connected to the operation of nuclear units, all system for the reception, reloading and storage of spent fuel including the auxiliary cleaning systems, systems of special air-conditioning including the ventilation stack, radiation control, systems for collection and treatment of waste water, storage of liquid and solid radioactive wastes, decontamination system, radiochemical control and system of physical protection, will be in operation.

The activities performed after the shutdown will be performed in terms of providing the level of nuclear safety, radiation protection, emergency preparedness and physical protection in order to avoid increasing the environmental risks compared to the preceding normal operation.

B.I.6.7.3. Preparation of decommissioning

The date of the definitive unit shutdown will have to be decided sufficiently ahead of the schedule before the start of the shutdown stage. Approximately 5 years are considered. The reasons include mainly the following activities and measures that have to be performed before the start of this stage:

- update, development and design of decommissioning variants,
- preparation of technical documents for the processing of decommissioning documentation,

- preparation of documentation for the decommissioning permit,
- preparation of projects for the stage of shutdown,
- technical and organisational and managerial activities.

During the period of preparation for decommissioning it will be necessary to consider and evaluate the experience from the operational period and incorporate it in the preparatory and implementation project documentation. That applies mainly to the data from the following areas:

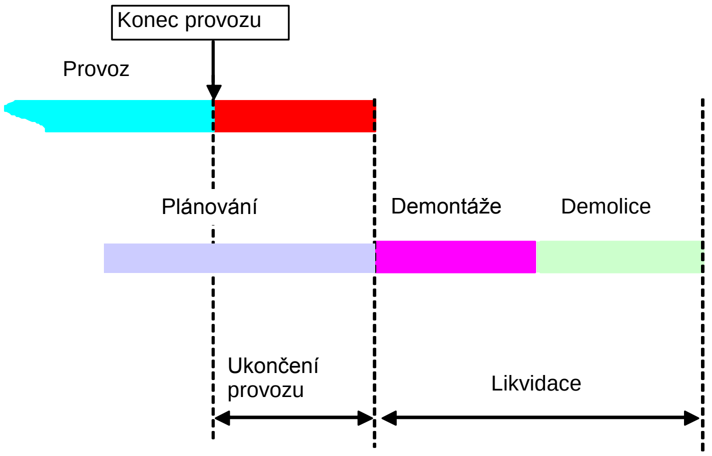
- maintenance and safeguard of operation,
- evaluation of the results of regular general overhauls,
- modernisation and modification of systems and components,
- results of evaluation of radiation situation during the operation.

B.I.6.7.4. Decommissioning

The goal of the nuclear power plant decommissioning is to enable the use of the power plant premises, possibly their part for other purposes. With respect to the requirements of the existing legislation, two methods of decommissioning may be considered:

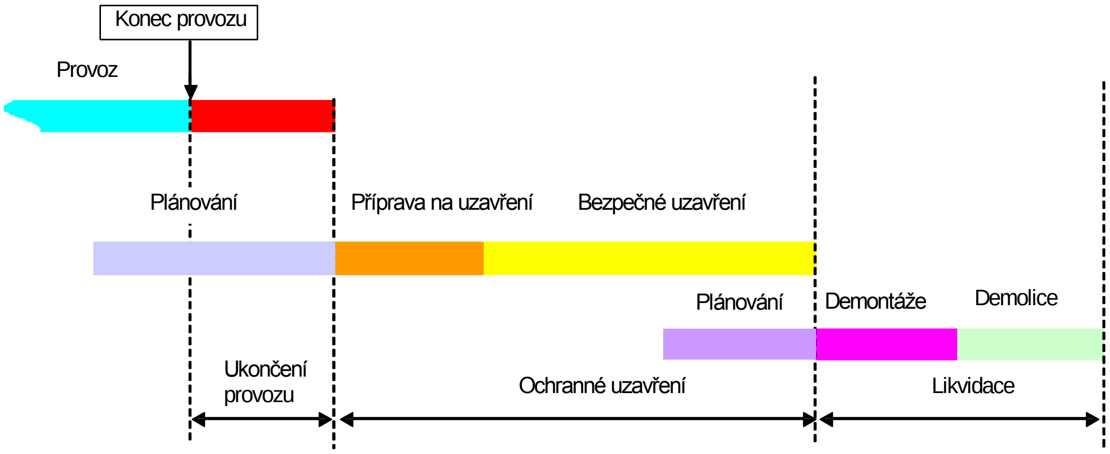
- immediate decommissioning, when the decommissioning activities will follow in a single material and time stage,
- delayed decommissioning when the decommissioning activities are divided into several successive material- and time-defined stages with a possible time delay between them.

Figure B.I.38: Immediate decommissioning method



Konec provozu	End of operation
Provoz	Operation
Plánování	Planning
Ukončení provozu	Decommissioning
Demonáže	Dismantling
Demolice	Demolitions
Likvidace	Liquidation

Figure B.I.39: Delayed decommissioning



Konec provozu	End of operation
Provoz	Operation
Plánování	Planning
Ukončení provozu	Decommissioning
Příprava na uzavření	Preparation for closure
Ochranné uzavření	Protective closure
Bezpečné uzavření	Safe closure
Plánování	Planning
Bezpečné uzavření	Safe closure
Demonáže	Dismantling
Demolice	Demolitions
Likvidace	Liquidation

For the already operational Temelín Nuclear Power Plant units, three variants of decommissioning were chosen. One variant of immediate decommissioning and two variants of delayed decommissioning with different ranges of protective shutdown. Within the permit documentation for operation of unit 1 and 2, the proposal of the method of decommissioning and estimate of decommissioning costs verified by the Radioactive Waste Repository Authority was prepared in accordance with Nuclear Act requirements. This documentation is subject to regular update and, in the case that the decision for construction of units 3 and 4 is made, the respective impacts and relations will be dealt with. For the submittal of the application for the location of units 3 and 4, a draft policy for safe shutdown will be prepared which will also consider the existence of already operational units and variants of their future decommissioning.

In accordance with the current policy and goals of power engineering in the Czech Republic, as well as within the EU, a method of project disassembly for further use of the Temelín location will be selected. In terms of the strategy of decommissioning, the assumption that the Temelín location will probably continue to be used for the commercial purposes of ČEZ, a. s., is important. This assumption logically follows from the concept of managing the land and structures used for the generation of electric power in the Czech Republic and from the requirement for maximum funds saving in constructing the new power sources. Therefore it will be appropriate to choose the method of classification of individual structures in the location into the groups based on the needs of decommissioning the nuclear power plant. There are four groups of structures:

- the so called "active structures" (or the primary part structures),
- auxiliary structures operated for the needs of the decommissioning process,
- the structures demanding in terms of disassembly and demolitions, and
- other structures insignificant for the decommissioning process that can be disposed of already during the decommissioning preparation period.

The end of decommissioning may apply to the decommissioning of the nuclear power plant either without any limitations or with a limitation for it to be used for further radiation activities. The operator will decide on its further use based on the legal regulations applicable at that time, its needs and the conditions of the structural and technological part of the plant.

B.I.7. Expected dates of project execution commencement and completion

Expected construction start date:	during 2013
Expected date of construction completion, launch:	during 2020 (first unit followed by the second unit)

B.I.8. List of affected self-governing territorial units

Regions:	South-Bohemian Region	South-Bohemian Region U Zimního stadionu 1952/2 370 76 České Budějovice tel.: 386 720 111 e-mail: posta@kraj-jihocesky.cz http://www.kraj-jihocesky.cz/
Municipalities:	Temelín municipality	Temelín municipality Temelín 104 373 01 Temelín tel.: 385 734 311 e-mail: info@obecTemelín.cz http://www.obecTemelín.cz/
	Dříteň municipality	Dříteň municipality Dříteň 152 373 51 Dříteň tel.: 387 991 121 e-mail: podatelna.driten@necoss.net http://www.obecdriten.cz/

B.I.9. List of associated decisions as per Section 10, paragraph 4, and the administrative authorities to issue such decisions

The list of associated decisions as per Section 10, paragraph 4 of Act. no. 100/2001 Coll., on the assessment of environmental impacts, and the administrative authorities to issue such decisions.

- *Licence for siting of a nucear installation*

  State Office for Nuclear Safety, Senovážné náměstí 9, 110 00 Praha 1

- *Site decision*

  Municipal Office, Týn nad Vltavou - department of regional development, Náměstí míru 2, 375 01 Týn nad Vltavou (unless, in accordance with section 17 of the building law, the superior building office, i.e. Regional Authority of the South-Bohemian Region, department of regional planning, building code and investments, U Zimního stadionu 1952/2, 370 76 České Budějovice, reserves the authority of the first degree building office)

- *Licence for a construction of a nuclear installation*
  State Office for Nuclear Safety, Senovážné náměstí 9, 110 00 Praha 1
- *Construction permits including special (development of water resources and railways)*
  - *General (excluding development of water resources and railways)*
    Ministry of Industry and Trade, Na Františku 32, 110 15 Praha 1
  - *Development of water resources*
    Municipal Office Týn nad Vltavou - department for the environment, Náměstí míru 2, 375 01 Týn nad Vltavou
  - *Railway development*
    Rail authority, building division, Škroupova 11, 301 36 Plzeň
- *Permission for water use (permit to withdraw and discharge waters)*
  - *Permission to withdraw technological water from the Vltava River*
    Municipal Office Týn nad Vltavou - department for the environment, Náměstí míru 2, 375 01 Týn nad Vltavou
  - *Permission to discharge waste water*
    Regional Authority of South-Bohemian Region - department for the environment, agriculture and forestry, U Zimního stadionu 1952/2, 370 76 České Budějovice
- *Licence for particular stages of nuclear installation sommissioning and for operation*
  State Office for Nuclear Safety, Senovážné náměstí 9, 110 00 Praha 1
- *Licence for discharge of radionuclides into the environment*
  State Office for Nuclear Safety, Senovážné náměstí 9, 110 00 Praha 1
- *Final inspection approval including special (development of water resources and railways)*
  - *General (excluding development of water resources and railways)*
    Ministry of Industry and Trade, Na Františku 32, 110 15 Praha 1
  - *For development of water resources*
    Municipal Office Týn nad Vltavou - department for the environment, Náměstí míru 2, 375 01 Týn nad Vltavou
  - *For railway development*
    Rail authority, building division, Škroupova 11, 301 36 Plzeň

Possible further proceedings will be conducted in accordance with respective regulations.

B.II. INFORMATION ON INPUTS

B.II.1. Soil

B.II.1.1. Period of operation

2. PROJECT (UNITS 3+4)

Permanent appropriation: new nuclear power plant: approximately 639,013 m^2, in that:

other areas: approximately 310,335 m^2
ALF: approximately 328,678 m^2
LIFFF: 0

The extent of appropriation is given by the definition of area for the NNPP location.

electric power output: approximately 1,390 m^2, in that:

other areas: 0
ALF: approximately 1,390 m^2
LIFFF: 0

The extent of land appropriation for the power output is given by the area of foundation structures for line poles.

increase of raw water supply capacity: 0

The raw water supply line route does not require permanent land appropriation. The raw water supply line will run in the corridor below terrain.

Affected land plots: new nuclear power plant:

Table B.II.1: List of land plots affected by the situation of the new nuclear power plant

Plot no.	Cadastral area	Land protection	Plot type	Ecological unit	Appropriation area approximately [m^2]	Permanent removal from ALF [m^2]
1044/3	Temelínec	-	other land		123,594	
1044/23	Temelínec	-	other land		3,313	
1044/24	Temelínec	-	other land		2,235	
968/2	Temelínec	ALF	permanent herbage	-	91	91
1150/5	Temelínec	-	other land		138	
1150/4	Temelínec	-	other land		199	
1150/89	Temelínec	ALF	permanent herbage	-	9	9
1150/32	Temelínec	-	other land		77	
1150/88	Temelínec	ALF	permanent herbage	-	106	106
990/5	Temelínec	ALF	permanent herbage	-	14,150	14,150
990/2	Temelínec	ALF	arable land	-	185,521	185,521
16/3	Temelínec	ALF	permanent herbage	-	600	600
990/76	Temelínec	ALF	permanent herbage	-	10,810	10,810
990/83	Temelínec	ALF	permanent herbage	-	400	400
990/38	Temelínec	ALF	arable land	-	15,700	15,700
990/48	Temelínec	ALF	arable land	-	36,832	36,832
990/90	Temelínec	ALF	arable land	-	1,117	1,117
990/52	Temelínec	ALF	arable land	-	3,715	3,715
990/53	Temelínec	ALF	arable land	-	2,351	2,351
990/60	Temelínec	ALF	arable land	-	40,046	40,046
300/1	Křtěnov	ALF	arable land	-	14,634	14,634

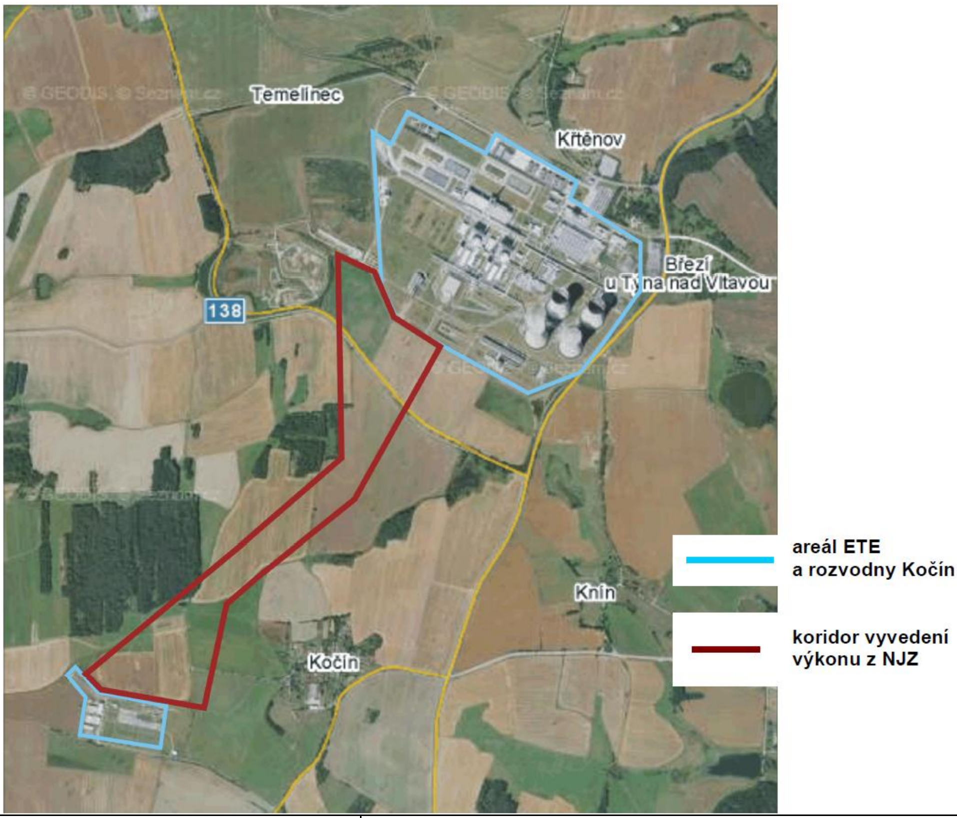
990/65	Temelínec	ALF	arable land	-	1,667	1,667
990/70	Temelínec	ALF	arable land	-	929	929
180/1	Křtěnov	-	other land		173,792	
1044/25	Temelínec	-	other land		6,987	

Areas for the NNPP construction are located on the land plots originally designed for the construction of units 3 and 4, cooling towers and related auxiliary building structures and technological equipment. They are, to a significant extent, the areas that were removed permanently in the past.

The NNPP construction area location is marked schematically below in subchapter B.II.1.2. Preparation and implementation period (area 3)

electric power output:

Figure B.II.1: Schematic of corridor for power output

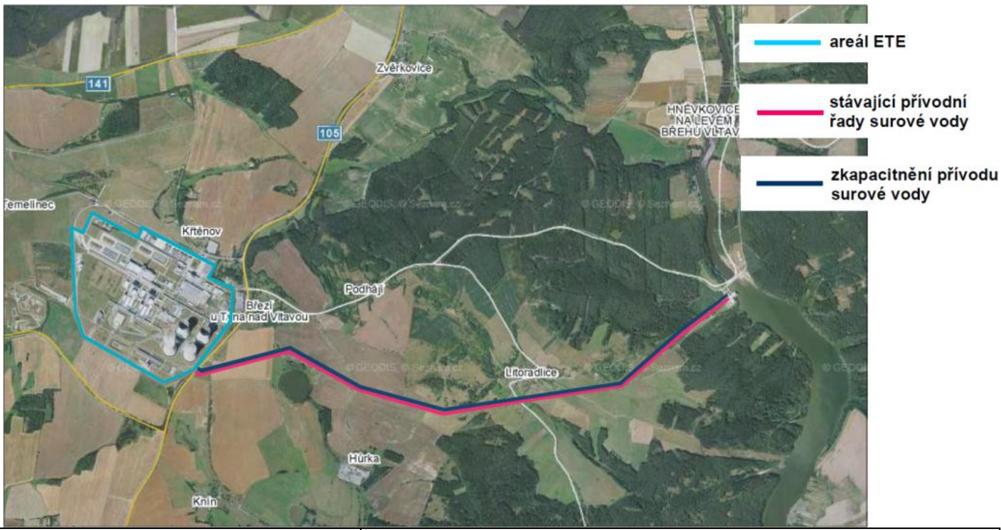


Areál ETE a rozvodny Kočín	TPP and Kočín switchyard complex
Koridor vyvedení výkonu z NJZ	Power output lines corridor from NNPP

The corridor for power output is located parallel with the existing lines. It only affects AFL land and may thus marginally (by protective zone) stretch to LIFFF.

increase of raw water supply capacity:

Figure B.II.2: Schematic of corridor for raw water supplies



Areál ETE	Temelín PP complex
Stávající přívodní řady surové vody	Existing raw water supply piping
Zkapacitnění přívodu surové vody	New raw water supply piping

The corridor for potential increase of raw water supply is located parallel with the existing pipeline mains.

PLANT (UNITS 1+2+3+4)

Permanent appropriation: power plant after expansion: approximately 1,872,383 m^2

The existing Temelín Power Plant is situated on the land plots with an area of 1,233,370 m^2, the boundary of permanent appropriation matches the shape of the power plant fencing.

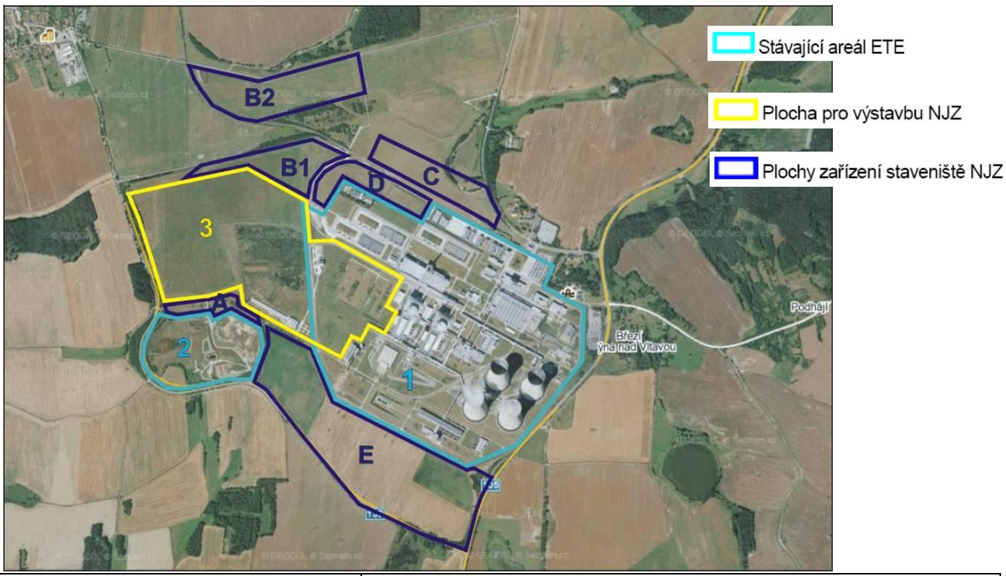
B.II.1.2. Preparation and implementation period

Temporary appropriation:	site facilities:		approximately 826,564 m^2, in that:
		other areas:	approximately 71,996 m^2
		ALF:	approximately 754,568 m^2
		LIFFF:	0

The areas of temporary appropriation for the NNPP site facilities are located in the power plant neighbourhood. The prevailing majority includes the ALF areas, in the previous period used (temporary appropriation) for the construction of the existing power plant, and subsequently restored. The location of the areas is obvious from the following figure, where:

Area 1 includes the existing NPP Temelín premises.
Area 2 is used for power plant storage management.
Area 3 is the area necessary for the NNPP construction.
Areas A - E will be used for NNPP site facilities.

Figure B.II.3: Schematic of land appropriation areas



Stávající areál ETE	Existing TPP complex
Plocha pro výstavbu NJZ	Land for NNPP construction
Plochy zařízení staveniště NJZ	Land for NNPP site facilities

Informative surface areas of individual areas are as follows: A 29,962 m^2, B1 72,208 m^2, B2 156,499 m^2, C 81,190 m^2, D 64,776 m^2, E 421,929 m^2.

electric power output: 0

The construction of electric power output does not require temporary land appropriation. The construction period will be shorter than one year (including the time needed for restoration).

increase of raw water supply capacity: 0

The construction of raw water supply capacity increase does not require temporary land appropriation. The construction period will be shorter than one year, including the time needed for restoration.

B.II.1.3. Shutdown period

Permanent appropriation: 0

In the shutdown period, the additional permanent land appropriation will not be required.

Temporary appropriation: 0

In the shutdown period, additional temporary land appropriation will not be required.

B.II.2. Water

B.II.2.1. Period of operation

2. PROJECT (UNITS 3+4)

Service water: amount: approximately 67,000,000 m^3/year max.

The quantity of raw water withdrawal depends mainly on the installed power, as well as the climatic conditions. For the power alternative 2x1200 MW_e the max. withdrawal of approximately 50,000,000 m^3/year is considered, for the power alternative 2x1700 MW_e it is approximately 67,000,000 m^3/year max.

source: the Vltava River

The raw water will be withdrawn at the existing extraction point, i.e. the pumping station located on the left bank of the Hněvkovice waterworks reservoir. At present the supply to the power plant premises is provided using two DN1600 discharge pipeline mains (with a possibility to increase the capacity with one new main pipeline approximately DN1600) to the existing water reservoir on the NPP Temelín premises with the total capacity of 2x15000 m^3.

treatment: clarification, demineralised water production

As required, the raw water will be conducted from the existing water reservoir to the cooling water treatment, where the undesirable pollution will be removed using clarification. The amount of clarified water for the cooling cycle depends mainly on the raw water nature. The raw water will only be treated if it is significantly polluted, which disables its use as additional water for the cooling circuit. Production of demineralised water will take place year round. It will be prepared in the new chemical water treatment plant. The considered concept of chemical water treatment plant is based on the combining of reverse osmosis and ion-exchanger demineralisation.

Drinking water: amount: approximately 33,000 m^3/year max.

The number of NPP Temelín operating staff will increase by approximately 600 people. In case of a specific consumption 150 l/person/day the total annual increase in the period of operation will amount to approximately 32,850 m^3/year.

source: Zdoba water reservoir

Drinking water for the purposes of NNPP will be provided from the existing 2xDN400 supply mains from the Zdoba reservoir 3x1000 m^3.

Fire water: source: cooling circuit

In order to provide fire water for the external NNPP areas and for the structures that do not belong to category 1 of seismic resistance, 2 separate fire water pumping stations will be built. The fire water pumping stations will be located with each circulation cooling water pumping station, the supply of fire water for fire extinguishing will be satisfied by connecting it to the cooling circuit. Power supply for the pumps and other equipment will be carried out from 2 independent sources.

PLANT (UNITS 1+2+3+4)

Service water: amount: approximately 109,000,000 m^3/year max.

The existing permitted raw water withdrawal amounts to 42,000,000 m^3/year; the actual withdrawal for NPP Temelín from 2005 to 2008 was approximately 33 500 000 m^3/year.

source: the Vltava River

The raw water will be withdrawn at the existing extraction point, i.e. the pumping station located on the left bank of the Hněvkovice waterworks reservoir. At present the supply to the power plant premises is provided using two DN1600 discharge pipeline mains (with a possibility to increase the capacity with one new main pipeline approximately DN1600) to the existing water reservoir on the NPP Temelín premises with the total capacity of 2x15000 m^3.

treatment: clarification, demineralised water production

The existing water treatment for units 1+2 will be preserved (the water from the clarification process is conducted to ion-exchanger filters and mixing filters). For the NNPP a new chemical water treatment plant will be constructed, the considered concept is based on the combining of reverse osmosis and ion-exchanger demineralisation.

Drinking water: amount: approximately 133,000 m^3/year max.

At present the power plant operation and maintenance is provided by approximately 1,000 own employees of ČEZ and the number of employees of external contractors used mainly for the maintenance and repairs ranges normally around 200-300 employees and does not exceed 500 people during the peak. The drinking water withdrawal is provided by the contract between ČEZ a.s. and the supplier Vodovody a kanalizace Jižní Čechy a.s., České Budějovice, contract no. CB 0301/TE 8056. At present the contracted annual supply is 240,000 m^3/year, in that 195,000 m^3/year for drinking and sanitary purposes and 45,000 m^3/year for operating and technological purposes. The existing annual water consumption ranges around 100,000 m^3/year.

source: Zdoba water reservoir

Drinking water for the purposes of the NNPP will be provided from the existing 2xDN400 supply mains from Zdoba reservoir 3x1000 m^3.

Fire water: source: cooling circuit

At present the fire water supply is provided using 2 self-standing fire pumping stations, and a fire distribution line DN100-DN300, from which the branches are conducted to individual buildings. Fire stations are located in the inlet part of the cooling water pumping station for NPP Temelín unit 1 and 2. One of the fire stations is operational, the other is used as a spare station. If needed, both fire pumping stations can operate simultaneously.

The fire distribution line for the NNPP will be independent of the existing NPP Temelín fire distribution line. If needed, the fire networks of NPP Temelín and the NNPP can be interconnected. Therefore both systems will be provided with a separately lockable interconnection.

B.II.2.2. Preparation and implementation period

Drinking water: site facilities: approximately 164,250 m^3/year max.

The sanitary needs of construction workers are considered, the need of meal preparation, washing dishes, cleaning etc. is included. Approximately 3,000 workers are considered for the construction, the considered specific consumption is 150 l/person/day.

source: Zdoba water reservoir

Drinking water for the structures of site facilities will be delivered from the existing supply mains 2xDN400 from the Zdoba reservoir 3x1000 m^3.

Today, the drinking water withdrawal is provided by the contract between ČEZ a.s. and supplier Vodovody a kanalizace Jižní Čechy a.s., České Budějovice, contract no. CB 0301/TE 8056. At present the contracted annual supply is 240,000 m^3/year, in that 195,000 m^3/year for drinking and sanitary purposes and 45,000 m^3/year for operating and technological purposes. The existing annual water consumption is about 100,000 m^3/year.

It follows from the abovementioned that in the period of construction, the demand for drinking water will be higher (100,000+164,250 = 264,250 m^3/year), than currently contracted (240,000 m^3/year). It will therefore be necessary to apply for the increase of withdrawal above the existing permitted amount.

Raw water: construction: unspecified

During the construction, the raw water will be used as service water (spraying of surfaces, reduction of dust formation etc.) and it is expected that in order to increase the possibility of its use, it will be treated secondarily at the construction site in order to achieve the quality of mixing water for certain types of building materials. The large amount of the water will be withdrawn at the place of production of concrete mixtures, mortars and other materials. Amount unspecified (in the order of approximately 100,000 m^3/year).

source: NPP Temelín water reservoir

During the construction the supply to NPP Temelín will be carried out in the existing way, i.e. by pumping from the Hněvkovice waterworks reservoir to the NPP Temelín reservoir with the capacity of 2x15000 m^3. For the needs of construction, the raw water will be withdrawn from the existing raw water reservoir; the site facilities will be connected to the water reservoir using a new temporary supply mains.

The amount of withdrawn water for the purposes of construction will be small compared to the total amount of raw water pumped to the NPP Temelín premises. On the stage of NNPP construction, there will be no need to supply raw water above the scope of possibilities of pumping for the existing units, the consumption of raw water will be within the existing permitted limits for water withdrawal.

B.II.2.3. Shutdown period

Service water, drinking water: unspecified

The withdrawn amount of water will gradually decrease during the shutdown stage depending on the progress of performed decommissioning activities and number of employees required for their implementation. Since the share of activities with higher water consumption, as well as the number of employees, will decrease as the decommissioning continues, the withdrawn amount of water will also decrease rapidly. Amount unspecified (in the order of approximately 10,000 m^3/year).

Water supply during the shutdown stage and other stages of NPP Temelín decommissioning is supposed from the same sources as during the normal unit operation. In the case that it will not be possible to use the sources any longer, they will be replaced depending on the possibilities on the respective stage of decommissioning.

B.II.3. Other raw material and energy resources

B.II.3.1. Period of operation

PROJECT (UNITS 3+4)

Nuclear fuel: power alternative 2x1200 MW_e: approximately 43.5-48.0 t UO_2/year (for 2 units)
power alternative 2x1700 MW_e: approximately 72.0-78.5 t UO_2/year (for 2 units)

Basically, the fuel will be based on UO_2, however, the use of MOX-type fuel is not excluded. Maximum fuel enrichment is expected in the range of approximately 4.8% to 5% ^{235}U. The fuel rods will be arranged in tetragonal or hexagonal fuel sets. The total amount of fuel in the reactor will consist of approximately 157 to 241 fuel sets.

The total amount of fuel in the reactor core will be approximately 87 to 157 t (UO_2). The fuel burn-out is expected in the range of 60-70 MWd/kg. The fuel cycle lengths are expected to range between 12-24 months.

Electric power: approximately 160-220 MW (for 2 units)

The specified value represents the internal consumption input of electric power for two power plant units. The unit means including the proportionate part of related non-unit systems.

Operating masses: t hundreds/year

The consumption of chemicals for the primary part consists mainly of the chemicals for the maintenance of chemical regimens IO, chemicals for regeneration solutions and chemicals for decontamination solutions. Preparation of solutions is performed as required. The chemicals used in the secondary as well as primary part are drawn from the secondary part for use in the primary part in compliance with the current requirements of the operation and they are specified in summary in the consumption of chemicals for the secondary part. The expected requirements for the operating masses of the primary part (data for 2 units): citric acid min. 99% (max. 4 t/year), potassium hydroxide min. 85% pellets (max. 16 t/year), boric acid (max. 270 t/year), lithium hydroxide (max. 22 kg/year), nitric acid 66% (max. 25.4 t/year).

The requirements of operating masses for the secondary part are mainly given by the consumption of chemicals for the production of demineralised water, chemicals for the treatment of turbine condensate and chemicals for the treatment of additional cooling water. While the demineralised water is prepared all year round, the treatment of turbine condensate is performed only during the unit startup or in case of extraordinary penetration of cooling water in the condenser. The treatment of additional cooling water is carried out only in the case of exceptionally impaired quality of raw water, based on the experience approximately 2 weeks in a year. The expected requirements of the operating masses for the secondary part (data for 2 units): $Fe_2(SO_4)_3$ 40% (max. 291 t/year), polymer coagulant 100% (max. 7.1 t/year), H_2SO_4 96% (max. 39.7 t/year), NaOH 42% (max. 82.3 t/year), polymer organic flocculant 100% (max. 5.9 t/year), NaClO 14% for RO (max. 5.9 t/year), anti-scalant RO 100% (max. 2.5 t/year), $Na_2S_2O_3$ 30% (max. 4.1 t/year), NH_3 22% (max. 248.9 t/year), N_2H_4 4.9% (max. 186.3 t), NaClO 14% for CHO (max. 135 t/year).

The consumption of petroleum substances includes diesel (max. 140 t/year), turbine oil (max. 34 t/year), transformer oil (max. 1 t/year), motor oil (max. 20 t/year), synthetic oil (max. 17 t/year), light fuel oil (max. 115 t/year), other oils (max. 3 t/year).

The consumption of technical gases includes nitrogen, hydrogen and CO_2 for the operation of individual units, oxygen, acetylene, argon, possibly other technical gases for maintenance. The amount is not specified in more details.

PLANT (UNITS 1+2+3+4)

Nuclear fuel: approximately 89.5-124.5 t UO_2/year

The total nuclear fuel requirements consist of the NNPP requirements and the existing consumption of nuclear fuel, which makes approximately 46 t UO_2/year.

Electric power: approximately 300-360 MW

The total requirements for internal consumption of electric power will be approximately twice as big compared to the existing situation, while the internal consumption input of electric power for both existing units makes approximately 140 MW.

Operating masses: t hundreds/year

The total consumption of chemicals for both primary and secondary parts will be approximately twice as big compared to the existing state.

B.II.3.2. Preparation and implementation period

Building materials:	concrete and reinforced concrete:	max. 1,000,000 m^3
	concrete reinforcement:	max. 136,000 t
	steel structures:	max. 50,000 t

The total volumes of critical building materials are related to the two NNPP units. All in lump sum for the time of construction.

B.II.3.3. Shutdown period

Building and construction materials: unspecified

The amount of building, possibly construction materials for the shutdown period is not specified. In general, the requirements will be of small account.

B.II.4. Requirements on transport and other infrastructures

B.II.4.1. Period of operation

PROJECT (UNITS 3+4)

Transport of employees:

employees:	approximately 600
persons per parking space:	approximately 1.5
new parking spaces:	approximately 422
passenger cars:	approximately 500 cars/day max.(average)

The transport of employees means the transport of permanent operating and maintenance staff to the workplace including transport using passenger cars or buses. The construction in advance of new parking spaces for passenger cars is considered. It follows from the tendencies in road transport that during NNPP operation, compared to the present situation, the increase of bus transport cannot be expected, while transport using passenger cars can.

Transport of operating masses, materials and equipment for maintenance:

cargo vehicles:	approximately 25,500 vehicles/year max.(annual average) approximately 110 vehicles/day max. (daily maximum)

The specified values are based on the assumption that during NNPP operation, the number of cargo vehicles entering and exiting the guarded area will increase by 100% compared to the existing situation. In order to specify the daily maximum, the basis considers the existing maximum in individual months, 90% out of those values take place on weekdays.

During the daytime (i.e. from 6 a.m. to 10 p.m.) 95% of transport takes place, while 5% of transport takes place at night, i.e. the peak transport for operation and maintenance does not exceed approximately 104 daytime passages and 6 passages at night time.

Nuclear fuel transport:

transports:	approximately 1 to 2 a year

On average the need of one delivery a year that will satisfy the annual consumption of both units, can be considered, however, depending on the situation in the market, it may be favourable for the operator to buy the fuel for several years in advance. Since nuclear fuel is not produced in the Czech Republic, it is certain that it will be delivered from abroad and the means of delivery may combine railway, road, water and air transport.

Until the deep repository is put into operation, the spent nuclear fuel will only be transported within the power plant premises, which does not place any requirements on external transport infrastructure. After the start of transport to the deep repository (possibly for reworking), the railway transport is considered, while the frequency of transport will be very low and it will not burden the railway network significantly in any direction considerable.

Radioactive waste transport

transports:	approximately tens of vehicles/year

Dukovany repository, which is under the administration of the state organisation RAWRA is designed for the reposing of radioactive waste from the operation of all units of nuclear plants located in the territory of the Republic in accordance with the existing "Policy of Radioactive Waste Management and Spent Fuel Management". All solid wastes and solidified liquid wastes that meet the conditions of acceptability applicable for this repository will therefore be transported using the trucks on the route Temelín - Dukovany under the same conditions that apply to the present transport of radioactive wastes from the existing power plant.

Inactive waste transport:

cargo vehicles:	approximately 190 vehicles/year

Generation of waste in the "other" category except the municipal waste and inactive sludge from NNPP is estimated to approximately 2,500 t/year. Like so far, the wastes will be separated, collected at the previously specified collecting points and subsequently handed over for final disposal to specialised companies authorised to handle wastes, or to the waste dumping site in location no. 6 - Temelínec. With cargo vehicle payload of 15 t it means approximately 167 vehicles a year.

The "other" category waste of municipal waste nature will be separated in order to be used as secondary raw material (paper, plastic, glass etc.) to the maximum extent. Only the materials that cannot be used that way, will be transferred to the municipal waste dumping site in the 6 Temelínec location. The total production of municipal NNPP waste will be approximately 120 t/year, which means in the case of a 9 t vehicle payload approximately 14 vehicles in one direction (transport distance approximately 2 km). The dumping site capacity is sufficient for NNPP operation; no additional transport requirements are incurred in the course of the operation.

The "other - inactive sludge" waste category will be transported using the pipeline transport from the NNPP water treatment plant to the sludge lagoon in location no. 6 Temelínec. In this case the capacity of the sludge lagoon is also sufficient for the entire NNPP operational period.

The hazardous waste category will be generated in the NNPP in the amount of approximately 112 t/year max. and it will be handed over to a person authorised to its acceptance in order to deposit it to the dumping site of the respective category. The distance of proper hazardous waste dumping sites is approximately 16-20 km from NPP Temelín.

Total transport costs:

The following figure shows the traffic volumes on significantly affected roads in the form of a transport cartogram, which is completed with a table showing the specific data of average daily numbers of passing vehicles.

Figure B.II.4: Traffic volumes on roads around NPP Temelín due to NNPP operation

LEGENDA	LEGEND

2000 vozidel	2,000 vehicles
(1 mm = 1000 vozidel)	(1 mm = 1,000 vehicles)

Table B.II.2: Traffic volumes of most affected roads around NPP Temelín due to NNPP operation [vehicles/day]

Road section	Total	Heavy
NNPP - Temelín - Albrechtice nad Vltavou	44	4
NNPP - Týn nad Vltavou	412	42
Týn nad Vltavou - Březnice - Sudoměřice u Bechyně	82	8
NNPP - Hluboká nad Vltavou	618	64

Demands on other infrastructure: insignificant

The project does not place any demands on new external infrastructure in terms of steam, hot water or gas supply. The heating of NNPP structures will use the internal NNPP and NPP Temelín distribution lines. The units proper, possibly the backup boiler room, will be the sources of heat.

Demands on external infrastructure in terms of communication facilities can be handled using common means (possible consolidated use of the existing infrastructure).

The issues of other infrastructure (water, electric power) are dealt with in the respective chapters of this documentation.

PLANT (UNITS 1+2+3+4)

Transport of employees:

employees: approximately 1,500
persons per parking space: approximately 1.5
parking spaces: approximately 950
passenger cars: approximately 1,000 cars/day max. (average)
buses: approximately 20 vehicles/day max. (average)

The transport of employees means the transport of permanent operating and maintenance staff to the workplace including transport using passenger cars or buses.

Transport of operating masses, materials and equipment for maintenance:

cargo vehicles: approximately 51,000 vehicles/year max. (annual average)
approximately 220 vehicles/day max. (daily maximum)

The specified values mean the conservative estimate of traffic load, based on the assumption that the NNPP will double the existing traffic intensity.

During the daytime (i.e. from 6 a.m. to 10 p.m.) 95% of transport takes place, while 5% of transport takes place at night, i.e. the peak transport for operation and maintenance does not exceed approximately 208 daytime passages and 12 passages at night time.

Nuclear fuel transport:

transports: approximately 2 a year

On average, the need of two deliveries a year that satisfies the annual consumption for four units, can be considered. Depending on the situation in the market, it may be favourable for the operator to buy the fuel for several years in advance; in such case the number of transports will be modified properly. In terms of transport, this is an insignificant load. Since nuclear fuel is not produced in the Czech Republic, it is certain that it will be delivered from abroad and the means of delivery may combine railway, road, water and air transport.

Until the deep repository is put into operation, the spent nuclear fuel will only be transported within the power plant premises, which does not place any requirements on external transport infrastructure. After the start of transport to the deep repository (possibly for reworking), railway transport is considered, while the frequency of transport will be very low and it will not burden the railway network significantly in any direction considerable.

Radioactive waste transport

transports: approximately tens of vehicles/year

Dukovany repository, which is under the administration of the state organisation RAWRA, is designed for the reposing of radioactive waste from the operation of all units of nuclear plants located in the territory of the Republic in accordance with the existing "Policy of Radioactive Waste Management and Spent Fuel Management". All solid wastes and solidified liquid wastes that meet the conditions of acceptability applicable for this repository will therefore be transported using trucks on the route Temelín - Dukovany under the same conditions that apply to the present transport of radioactive wastes from the existing power plant.

Inactive waste transport:

cargo vehicles: approximately 380 vehicles/year

Generation of waste in the “other” category except the municipal waste and inactive sludge from NPP Temelín is conservatively estimated to approximately 5,000 t/year. Like so far, the wastes will be separated, collected at the previously specified collecting points and subsequently handed over for final disposal to specialised companies authorised to handle wastes, or to the waste dumping site in location no. 6 - Temelínec. With a cargo vehicle payload of 15 t it means approximately 334 vehicles a year.

The “other” category waste of municipal waste nature will be separated in order to be used as secondary raw material (paper, plastic, glass etc.) to the maximum extent. Only the materials that cannot be used that way, will be transferred to the municipal waste dumping site in the 6 Temelínec location. The total production of municipal waste from NPP Temelín will be approximately 240 t/year, which means, in the case of a vehicle payload of 9 t approximately 28 vehicles in one direction.

The “other - inactive sludge” waste category will be transported to the sludge lagoon in location no. 6 Temelínec from the NPP Temelín water treatment plant using the pipeline transport.

The waste of hazardous category will be generated in NPP Temelín in the amount of approximately 224 t/year max. and it will be handed over to a person authorised to its acceptance in order to deposit it to the dumping site of the respective category. The distance of proper hazardous waste dumping sites is approximately 16-20 km from NPP Temelín.

B.II.4.2. Preparation and implementation period

Transport of construction employees:

passenger cars: approximately 400 cars/day (average)
buses: approximately 80 vehicles/day (average)

The number and transport of construction employees to the NNPP construction site is expected as follows: in total there will be approximately 3,000 people. In that number 2,000 employees from Týn nad Vltavou (with temporary accommodation) are expected and also 600 people from České Budějovice, 200 people from Písek and 200 people from other places (mainly from the Temelín neighbourhood - with permanent residence). 20% of them are expected to use a passenger car (average occupation 1.5 persons/vehicle) and 80% a bus (average occupation 30 persons/vehicle).

Transport of building materials, structures and technological equipment:

cargo vehicles: approximately 400 vehicles/day (average)

The total volume of transport is derived using the following assumptions: on principle one-directional use of vehicles (i.e. for the load on the road network, always a double of journeys is considered, i.e. journey there + journey back loaded/empty); on principle the objective (source) of journeys is considered to be road II/138 NPP Temelín - Temelín (south of NPP Temelín), for all items the average time during which the transport is carried out is considered 2.5 year, i.e. 625 weekdays; the daily average is considered as 1.1 times arithmetic average of the sum of weekdays, it is assumed that the transport will be carried out mainly on weekdays and mainly in daytime (6 a.m. - 10 p.m.); in night time, transport amounting to 5% of the total volume is expected, the concurrence of all transports in the above-specified period of 625 weekdays is assumed (and evenly distributed during the entire above-specified time), the source of journeys is on principle the location of direct contractor (material manufacturer, or raw material source), not the subcontractors, vendors, distribution warehouses etc.; in case of manufacturers the volumes of transport amounting to the values of their existing (or assumed) production capacities are expected, i.e. without further (single-purpose) demands on transport of raw materials, components, etc. to their factories. The assumptions for cargo transport were formulated in order to consider the worst situation possible that might occur during the construction. In order to specify the volume of transport recalculated per number of cargo vehicles, the following parameters (payloads and cargo space) of type groups of vehicles were used: solo: 12.0 t, 10.8 m^3, set: 22.0 t, 20.0 m^3, bulk: 24.6 t, 19.7 m^3. The expected composition will be 30% sets, 45% bulk, 25% solo. The average payload then makes 20.7 t/vehicle (set) and the average cargo space 17.6 m^3/vehicle (set). The transports are allocated to individual roads in the area, the routes are selected on principle as natural without the assumption of use of traffic regulating measures. The cartogram of traffic volumes during the construction is specified below.

The transport of enormous and heavy components applies to single pieces, in terms of intensity it is therefore insignificant. In terms of space requirements the route to the Temelín location was verified in feasibility studies, which did not result in any significant demands on the modification of existing roads and transport infrastructure. They only include the directional and local modifications, partial expansion and repairs of existing transport infrastructure.

Transport of wastes: cargo vehicles: approximately 10 vehicles/day (average)

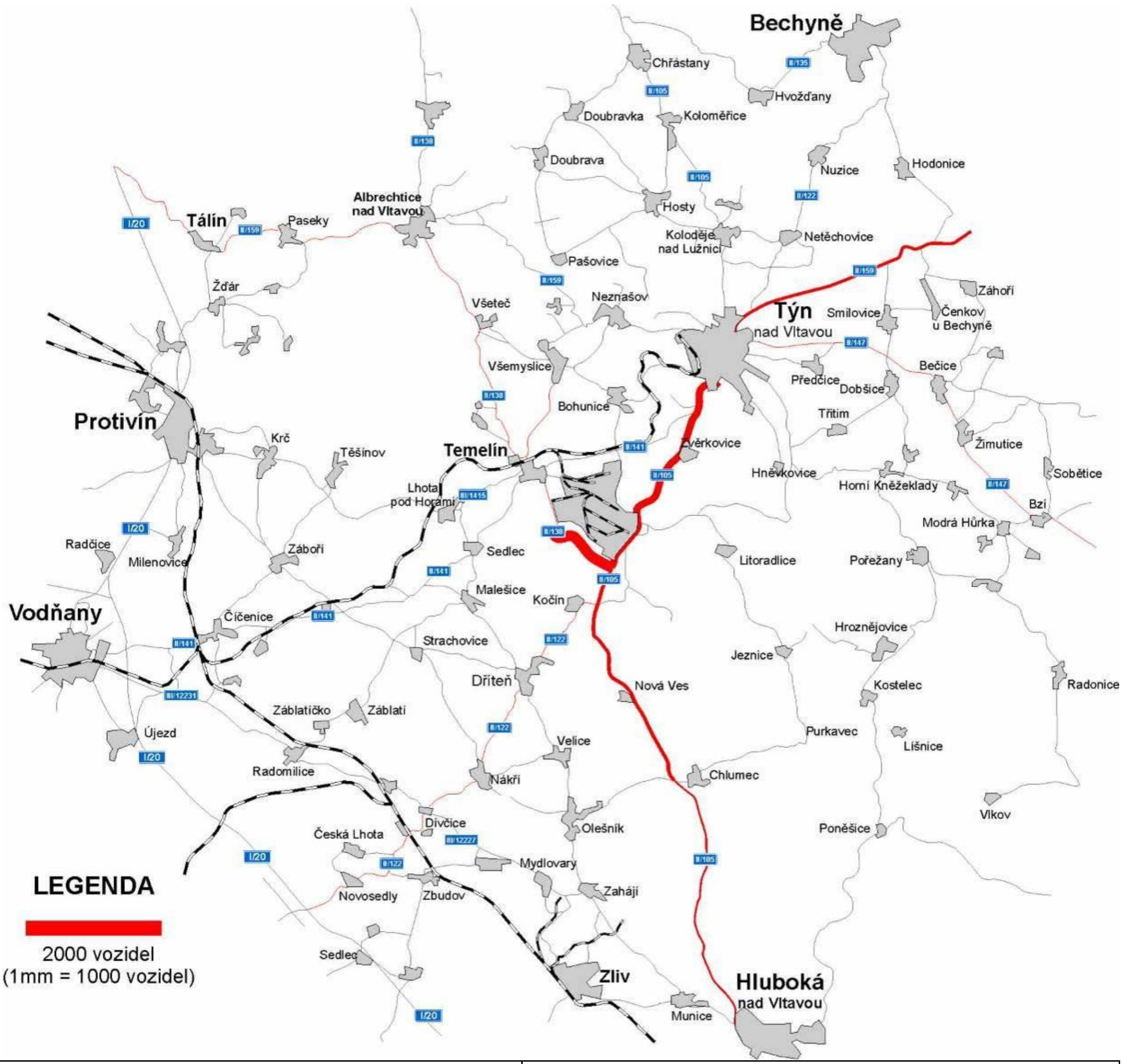
The “other” waste category of a building nature (approximately 98% of the total generated waste) will be recycled to approximately 75% using a recycling line, located in the construction area, the site facilities area, and used to a maximum extent possible in construction, e.g. in production of concrete bases, for the base courses of roads, for non-structural concrete fillers (non-technological structures), for backfills and subbases of utilities, reinforcement and modifications of surfaces, for the areas and structures of site facilities etc. The remaining approximate 25% will be removed to the dumping site S-IO in the location of 6 - Temelínec, neighbouring with the area of construction. It includes approximately 87,500 t of waste, which will be removed from the place of origin to location 6 using cargo vehicles. With a cargo payload of approximately. 15 t it means approximately 5,833 vehicles in one direction. The time course of the building waste generation is not known at present. Based on the experience from the existing NPP Temelín construction, the generation of a rather huge amount of building waste can be expected from the evacuation of the construction site (demolitions, relaying of utilities etc.) at the beginning of the construction stage. On the construction stage of NNPP, the generation of building waste will decrease. A more significant increase in building waste can be expected at the end of construction when the structures of site facilities will be disposed of. The “other” waste category of municipal waste nature will be separated in order to be used as secondary raw material (paper, plastic, glass etc.) to the maximum extent. Only the materials that cannot be used that way, will be transferred to the municipal waste dumping site in the 6 Temelínec location. The total production of municipal waste will be approximately 5,000 t, which means, in the case of a vehicle payload of 9 t, approximately 556 vehicles in one direction. The time course of municipal waste generation will be similar to that for the building waste. The waste of “hazardous” category will make a very small amount of the total generated waste in terms of volume (approximately 0.2%). Hazardous waste will be handed over to a person authorised for its acceptance in order to deposit it at the dumping site of the respective category. The distance of proper hazardous waste dumping sites is approximately 16-20 km from NPP Temelín. The estimate was made based on the waste generation during the construction of NPP Temelín 1, 2. Today, with respect to the development (prefabricated halls etc.), a lower generation can be expected, but for the purposes of the estimate higher values were considered.

Total transport costs:

The following figure shows the traffic volumes on significantly affected roads in the form of a transport cartogram, which is completed with a table showing the specific data of average daily numbers of passing vehicles related to the construction.

The assumptions for cargo transport were formulated in order to consider the worst situation possible that might occur during the construction, which also includes 100% of transport volume concentrated on the road network and time of transport estimated to 2.5 years. Since the railway network, the capacity of which was verified, will be used for the maximum transport extent possible and the volume of transport will be distributed in time, the actual traffic volumes for the location will be lower.

Figure B.II.5: Traffic volumes on roads around NPP Temelín due to NNPP construction



LEGENDA	LEGEND
2000 vozidel	2,000 vehicles
(1 mm = 1000 vozidel)	(1 mm = 1,000 vehicles)

Table B.II.3: Traffic volumes of most affected roads around NPP Temelín due to NNPP construction [vehicles/day]

Road section	Total	Heavy
NNPP - crossroads of II/105 with II/138	1,437	744
NNPP - Temelín	163	110
Temelín - Všeteč	136	83
Všeteč - Albrechtice nad Vltavou	136	83
Albrechtice nad Vltavou - Tálín	136	83
Temelín - Všemylice	24	24
Temelín - Čížcenice	3	3
crossroads of II/105 with II/138 - crossroads of II/105 with III/12221	962	429
crossroads of II/105 with III/12221 - Týn nad Vltavou	962	429
Týn nad Vltavou - Březnice	376	76
Týn nad Vltavou - Bečice	132	132
Bečice - Dolní Bukovsko	132	132
crossroads of II/105 with II/138 - Chlumec	452	292
Chlumec - Hluboká nad Vltavou	192	32

crossroads of II/105 with II/122 – Nákří	23	23
Nákří – Dívčice	23	23

B.II.4.3. Shutdown period

Transport demands: will not exceed the transport demands at the time of operation, possibly construction

For the transport during the shutdown period, the same system of transport provision like during the operation, possibly the construction, is expected. During the shutdown stage, when a significant decrease in the employees of the decommissioned NPP Temelín, or an increase in the employees of specialised companies performing disposal activities, are not expected, the transport demands will be the same as during the operation. On following stages, the changes in organisational structure will be performed in terms of reduction of employees of less occupied divisions, possibly their cancellation. Therefore the extent of employee transport will decrease. The transport of operating masses will meet mainly the demands of the activities, including decontamination and handling RAW and inactive waste from disassembly and demolitions. The transport of nuclear fuel will take place only on the shutdown stage when within 5 years the fuel in OS will be removed to SNFR. The transport will be carried out in the same way and upon the same conditions as during the NPP operation. Unlike the NPP operation, the increase in the transport of radioactive waste and inactive waste from inactive disassembly and demolitions must be expected. The nuclear waste will be removed to RAWR Dukovany. The activated materials that do not satisfy the terms for the acceptability to RAWR Dukovany, will be removed to the already constructed deep repository. Inactive waste will be removed either for recycling or to the dumping site, depending on the type. Hazardous waste will be removed to be handed over to an authorised person.

B.III. INFORMATION ON OUTPUTS

B.III.1. Air

B.III.1.1. Period of operation

PROJECT (UNITS 3+4)

Point sources:

power alternative 2x1200 MW_e:

- CO_2: approximately 3,441.600 t/year
- CO: approximately 8.640 t/year
- NO_x: approximately 6.624 t/year
- dust: approximately 1.728 t/year
- hydrocarbons: approximately 2.016 t/year
- NH_3: approximately 49.276 t/year

power alternative 2x1700 MW_e:

- CO_2: approximately 3,587.142 t/year
- CO: approximately 7.464 t/year
- NO_x: approximately 5.118 t/year
- dust: approximately 2.132 t/year
- hydrocarbons: approximately 0.648 t/year
- NH_3: approximately 69.806 t/year

The specified values represent the expected maximum volume of emission generated by non-radiating point sources of both blocks (i.e. emergency sources and cooling towers). A detailed description of sources is specified in the dispersion study in the annexe hereof.

Line sources:

SO_2:	approximately 0.4 kg/year.km^{-1}
CO:	approximately 106.3 kg/year.km^{-1}
NO_x:	approximately 58.7 kg/year.km^{-1}
PM_{10}:	approximately 17.2 kg/year.km^{-1}
benzene:	approximately 0.6 kg/year.km^{-1}
benzo[a]pyrene:	approximately 0.007 kg/year.km^{-1}

The specified values represent the total volume of pollutants generated by transport, related with the operation of the project, per 1 kilometre travelled.

Areal sources: insignificant

In the operation of the project, the significant areal sources of air pollution will not be operated.

PLANT (UNITS 1+2+3+4)

Point sources:

dust:	approximately 0.243 t/year
SO_x:	approximately 0.044 t/year
NO_x:	approximately 11.761 t/year
CO:	approximately 3.395 t/year
VOC:	approximately 1.782 t/year
heavy metals:	approximately 0.000032 t/year
PCB:	approximately 5.0E-09 t/year
F:	approximately 0.001332 t/year
Cl:	approximately 0.001665 t/year
NH_3:	approximately 1.7 t/year

The specified values represent the expected maximum volume of emissions generated by non-radiating point sources on the premises of the existing power station (according to the data for 2008). To obtain the values of total outputs from the power plant after the expansion, the data regarding the NNPP sources must be added to the specified data for the existing NPP Temelín sources (see above for the project data (units 3+4)).

Line sources:

SO_2:	approximately 0.9 kg/year.km^{-1}
CO:	approximately 212.7 kg/year.km^{-1}
NO_x:	approximately 117.4 kg/year.km^{-1}
PM_{10}:	approximately 34.3 kg/year.km^{-1}
benzene:	approximately 1.1 kg/year.km^{-1}
benzo[a]pyrene:	approximately 0.015 kg/year.km^{-1}

The specified values represent the total volume of pollutants generated by transport, related to the operation of the expanded power plant, per 1 kilometre travelled.

Areal sources: insignificant

In the operation of the power plant after the expansion, the significant areal sources of air pollution will not be operated.

B.III.1.2. Preparation and implementation period

Point sources:

CO_2:	approximately 1,101.600 t/year
CO:	approximately 0.648 t/year
NO_x:	approximately 1.728 t/year
dust:	approximately 0.432 t/year

At the time of construction, the operation of the light fuel oil boiler room is expected within the site facilities. The boiler room will be used as a backup one during the shutdown of the existing units for approximately 100 h/year.

Line sources:

SO_2:	approximately 1.4 kg/year.km^{-1}
CO:	approximately 308.2 kg/year.km^{-1}

NO_x: approximately 170.3 kg/year.km^{-1}
PM_{10}: approximately 49.2 kg/year.km^{-1}
benzene: approximately 1.6 kg/year.km^{-1}
benzo[a]pyrene: approximately 0.021 kg/year.km^{-1}

The specified values represent the total volume of pollutants generated by transport, related to the construction of the project, per 1 kilometre travelled.

Areal sources:

power alternative 2x1200 MW_e:
NO_x: approximately 21.5 t
CO: approximately 45.1 t
PM_{10}: approximately 3.2 t
benzene: approximately 0.3 t

power alternative 2x1700 MW_e:
NO_x: approximately 22.4 t
CO: approximately 46.9 t
PM_{10}: approximately 3.3 t
benzene: approximately 0.3 t

As the areal source the area of construction site, possibly the site facilities and the operation of building mechanisms on the construction site area, possibly the site facilities will act. The above-specified data represent the total emission during the period of construction (6 years).

B.III.1.3. Shutdown period

Shutdown: will not exceed the preparation and implementation period

During the shutdown period the point and line sources related with the project operation will pass away. The emissions related to the disassembly, possibly demolition work will not exceed the emissions of the preparation and implementation period.

B.III.2. Waste water

B.III.2.1. Period of operation

PROJECT (UNITS 3+4)

Sewage water:

total amount: approximately 33,000 m^3/year max.
receiving water: the Vltava River, Kořensko segment

Method of handling the sewage waste water will be the same as the existing state (description see below in the part related to the power plant after expansion).

An increase in the NPP Temelín operating staff by 600 persons will mean the increase in the amount of sewage waste water by approximately 33,000 m^3/year.

Within the new nuclear power plant, a new sewage water sewerage system that will be connected to the existing NPP Temelín system will be constructed. The sewage water will be removed to the already reconstructed existing mechanical-biological waste water treatment plant, which has sufficient spare capacity for the NNPP operational demands.

Sewage waste water from the controlled area will be conducted using a separate sewage water sewerage system where its radiochemical inspection will take place. After that it will be conducted to the existing waste water treatment plant, where it will be treated separately from the other waste water; only after that will it be conducted to a joint examination trap and, after examination together with the other treated waste water, brought to the receiving water.

The method of discharge will match the existing state; the existing collecting examination trap for the treated waste water with the capacity of 500 m^3 will be completed with a new collecting examination trap (see above).

Service waste water

total: approximately 15,123,000 m^3/year max.
receiving water: the Vltava River, Kořensko segment

Method of handling the service waste water will be the same as the existing state (description seen below in the part related to the power plant after expansion).

The overall majority (approximately 99.5%) consists of service waste water from the secondary part, the remaining amount (approximately 0.5%) consists of the waste water from the controlled area.

Blowdown: The blowdown from the circulation cooling circuit, from the essential service water circuit and non-essential service water circuit will be conducted to the new examination trap built within the NNPP next to the existing examination trap and, after the examination of the whole content of the trap together with the other waste water, discharged to the Vltava in the Kořensko segment.

Waste water from purification: The excessive sludge is removed from the purifier with part of the water to the sludge densifier. From the sludge densifier the sludge is removed for processing to the cooling water treatment plant (sludge management), where it will be processed in the same way as in the existing state, i.e. densified using belt presses. The excessive water from the densifier will be returned back to the start of the purification process, sludges with the dry matter content approximately 50% will be transported using the pipeline to the inactive sludge lagoon in location no. 6 - Temelínec. Waste water from cooling water purification operated in the case of increased content of suspended substances in raw water during rains or thaw, will be treated using the existing system of sludge processing in the existing cooling water purification station. The sludge will be removed to the inactive sludge lagoon in the Temelínec. location

Waste water from ChWTP: Waste water from washing sand filters will be returned back before the purification process and the resulting sludge will be treated together with the sludge separated in the purification process. In addition to the internal waste water from sand filter washing and ion-exchanger regeneration, the ChWTP will also process the non-aggressive as well as aggressive waste from turbine condensate treatment regeneration. Non-aggressive waste water from sand filter washing and ion-exchanger regeneration, mixed beds and turbine condensate treatment will be recycled before purification. Aggressive waste water from regeneration of ion-exchangers, mixed beds and turbine condensate treatment will be neutralised in the neutralisation by adding NaOH or H_2SO_4 and after obtaining pH 6.5-9.0 it is conducted from the ChWTP using industrial sewers. The largest share in the waste water from ChWTP consists of the concentrate from reverse osmosis, which is not aggressive and can be removed directly from ChWTP using industrial sewers. All waste water from ChWTP that will not be reused in the technological process will be conducted to the new examination trap built within NNPP next to the existing examination trap and after the examination of the entire content of the trap, where also other waste water will be introduced (blowdown, treated oiled water, treated sewer water, sublimit water from the controlled area), it will be discharged to the Vltava in the Kořensko segment.

Waste water from self-contained condensate treatment: Non-aggressive waste water will be collected and pumped from the turbine condensate treatment to the purification. Waste water from turbine condensate treatment regeneration will be collected and pumped to the neutralisation in ChWTP, where it will be neutralised together with the aggressive waste water.

Oiled waste water: The amount of oiled water will be minimised using technical design in the NNPP operation. Its formation is bound mainly to the structures where oil is present as the medium. They include mainly the machine halls, diesel-generator stations, barrelling of oils and their storage. The generated oiled waste water will be primarily treated using the de-oiling equipment located as close to the place of origin as possible and conducted to the separator before discharge into the industrial sewers. The treated waste water will either be conducted to the raw water input or to the new examination trap (at the existing collecting examination trap 500 m^3 in the northwestern part of the premises), common for all NNPP waste water, and discharged to the Kořensko segment.

Waste water from the controlled area: With respect to the nature of NPP Temelín operation, all waters leaving the controlled area are and will be monitored in order to minimise the negative impacts on the population and environment.

Rain water	total:	approximately 154,854 m^3/year
	receiving water:	Strouha Brook (Býšov segment), after that the Vltava

Within the new nuclear power plant the new rain water sewerage system will be built, which will connect to the NPP Temelín system. The resulting discharge will be via the existing terminal main drain, safety basins and retention reservoir to the Strouha - Býšov segment, which were dimensioned for the original capacity of 4 NPP Temelín units and have a sufficient spare capacity for the NNPP needs.

PLANT (UNITS 1+2+3+4)

Sewage water:	amount:	approximately 133,000 m^3/year max.

The existing sewage waste water generation makes in balance approximately 100,000 m^3/year.

Waste water from the existing NPP Temelín sanitary facilities are removed to the mechanical-biological waste water treatment plant. The waste water treatment plant consists of three branches. With respect to the different nature of brought waste water, the WWTP is divided to two separate units. One is used for water from sanitary facilities, special laundries and sanitary loops from the controlled zone - line no. 1, the other is used for sewage water from uncontrolled zone - line no. 2. The third line is a spare one.

The composition of waste water from the NPP Temelín sanitary facilities is the same as for common sewage water. The waste water from the controlled area is brought to the treatment plant using a separate sewage water system after the radioactivity inspection of individual sources so that its composition in terms of radioactive dose meets the conditions set by water-management authorities.

The sewage waste water is cleared of coarse impurities by mechanical pre-treatment using machine screens and a vertical detritus tank. The pretreated water is pumped to the two-storey tank for biological treatment, and after that to an activation tank. From the activation tank, waste water flows over to the final settling tank. The treated water is removed to the measuring tank and from there to the collecting trap (the existing collecting examination trap with the capacity of 500 m^3 will be completed with a new collecting examination trap for the NNPP purposes).

The capacity of the reconstructed WWTP will be sufficient for the power plant operation after the NNPP expansion (i.e. for the total of approximately 1,300 + 600 = 1,900 employees).

Service waste water

total:	approximately 24,415,000 m^3/year max.
receiving water:	the Vltava River, Kořensko segment

The existing permitted amount of discharged service waste water makes 9,342,000 m^3/year.

The waste water disposal is carried out depending on individual types and potential pollution. All waste water discharged from NPP Temelín (service and sewage), except for rain water, is and will be conducted to the collecting reinforced concrete examination traps, located in the northwestern part of the premises. They include the existing collecting trap with the capacity of 500 m^3 which will be completed with a new collecting examination trap for the NNPP purposes.

From there the waste water is, and will be, removed using 2xDN700 waste pipeline sections to the discharging structure in Kořensko (building for valves and measurement). Before the entrance to the small water power plant, the measurement of waste water quantity and quality is and will be performed. After that the discharge of waste water is, and will be, conducted to the weir stage segment of the Kořensko waterworks, where the waste water inlet is, and will be, made to the discharge casing of the waterworks' flow turbine. If the SWPP in Kořensko weir is out of operation, the waste water is, and will be, discharged via one of two nozzles on dragon's teeth directly to the flow. The Kořensko waterworks creates the conditions for safe homogenising of waste water from NPP Temelín with the Vltava water.

The discharge of waste water is governed by the water-management decision ref. no. Vod 6804/93/Si including the changes based on the decision of the department of the environment of the District Authority in České Budějovice ref. no.10424/93/01-231/2-Si of 8 March 2002 and the decision of the Regional Authority of South Bohemia, Department of environment, agriculture and forestry ref. no. KUJCK 10012/2004 OZZL Ža of 14 April 2004.

The following limits are permitted for the existing operation:

Q_{max} = 501.1 l/s
$Q_{max\ year}$ = 9,342,000 m^3/year

From the qualitative indicators only those are specified that are related to the total annual drain, i.e. the limits of the input of pollutants that are bound to the change of power.

BOD5:	150 t/year
CODMn:	262 t/year
CODCr:	860 t/year
sulphates:	2,850 t/year
inorganic nitrogen:	140 t/year
phosphate phosphorus:	5.0 t/year
total phosphorus:	9.6 t/year
suspended solids:	280 t/year
nonpolar extractives:	1.0 t/year
Anionic surfactants:	7.5 t/year
DIS	3,750 t/year
pH:	6.5-9
temperature:	32.3°C

In the future, the waste water composition is also expected to be on the level of existing composition, since the same composition of raw water and the use of similar treatment procedures for the removed waste water are expected. Also the identical densifying of water Z = 4.5 in the cooling circuit is assumed.

Rain water

total:	approximately 414,000 m^3/year
receiving water:	Strouha Brook (Býšov segment), after that the Vltava

The existing rain water discharge equals approximately 266,000 m^3/year.

Within the new nuclear power plant the new rain water sewerage system will be built, which will connect to the NPP Temelín system. The resulting discharge will be via the existing terminal main drain, safety basins and retention reservoir to the Strouha - Býšov segment, which were dimensioned for the original capacity of 4 NPP Temelín units and have a sufficient spare capacity for the NNPP needs.

The total amount of rain water from the NNPP and existing NPP Temelín will not exceed the original design amounts considered for the original construction of 4 NPP Temelín units, i.e. the total drain will not exceed the value of 7.025 m^3/s in the case of intensity of 15-minute rain with periodicity p = 1, while the capacity of the main drain is 9.325 m^3/s (spare of 2.3 m^3/s for the safety overflow from the water reservoir).

B.III.2.2. Preparation and implementation period

Rain water

drain from the site facilities areas:	approximately 140,000 m^3/year

The existing drain from areas equals to approximately 35,000 m^3/year. For the NNPP site facilities, the areas are identified in the power plant neighbourhood, which were already used for the construction of NPP Temelín, however at present have been mainly reclaimed to fields and partly to vegetation (A, B, B2, C, D). In addition to these areas, the area to the south of the power plant (area E), defined by the power plant fencing, location of dumping sites in the former Temelínec village and roads II/138 and II/105, has been identified. This area is currently used for agricultural purposes. At the time of NPP Temelín construction this area contained the soil deposit and also the part of site facilities for NPP Temelín.

The construction of site facilities will result in the increase of discharge coefficient. It will increase from the existing average value of approximately 0.075 to the approximate average value of 0.3.

Individual areas will be drained as follows: Area A will remain drained in the existing direction, i.e. to the basin of Temelínský Brook. Drainage will be provided using the existing surface dikes made along the foot of the slope of the area. Area B will remain drained using the existing sewage sewer in the existing direction, i.e. to the basin of Palečkův Brook. Area B2 will remain drained using the existing sewage sewer in the existing direction, i.e. to the basin of Palečkův Brook. Area C will remain drained using the existing sewage sewer in the existing direction, i.e. to the basin of Palečkův Brook. Area D will remain drained using the existing sewage sewer in the existing direction, i.e. to the basin of Palečkův Brook. Area E will remain drained using the surface way (dikes) and drains partly to the basin of Temelínecký Brook, partly to the basin of Malešický Brook. If needed, it will be possible to use the power plant sewerage system in order to remove part of the water to the basin of Strouha Brook. Settling and retention tanks will be used for the drainage of areas.

Even if the drained amount from the site facilities increases, it will not exceed the amount from the drainage of the original areas of existing NPP Temelín site facilities. The considered areas for NNPP site facilities take the area of approximately 78 ha, while the original areas for NPP Temelín site facilities, for which the drainage system was designed, were on the area of approximately 200 ha. The basic system of the site facility area drainage (main sewers, settling and retention tanks) was preserved and reconstructed in the previous years and it is fully available for the purposes of the NNPP site facilities.

Sewage water: total amount: approximately 164,250 m^3/year

It is expected that the amount of sewage water will be the same as the drinking water consumption. Sewage waste water from the structures of site facilities will be removed to the existing mechanical-biological waste water treatment plant which will be reconstructed before the start of NNPP construction. The waste water treatment plant has three lines, at present only 2 of them are operated, the third one is the backup one. The treatment plant currently provides the treatment of sewage water for approximately 1,500 employees of NPP Temelín and contracting organisations participating in the power plant operation and maintenance. At the time of construction an increase of approximately 3,000 construction workers is expected. The treatment plant has sufficient capacity also for connecting the site facility structures. The sewage waste water will be repumped to the existing WWTP via the reconstructed Bučina sewage water treatment plant located on the premises of site facilities D.

Service water: total amount: no generation

Service waste water is not generated during construction . The water withdrawn for construction service purposes becomes part of the building materials or it vaporises.

The existing power plant operation (units 1 + 2), possibly its waste water generation, will not be affected by the construction.

B.III.2.3. Shutdown period

Service water, drinking water, rain water: unspecified

The total amount of removed water will decrease in connection with the progressing shutdown. The decrease in removed waters related to the cooling tower shutdown will be substantial. Due to the decrease in the number of employees on the NPP Temelín premises the removed sewage waters will decrease. The amount of removed rain water will also decrease slowly with the gradual decrease of hard surfaces during the performed area reclamation. The amount is unspecified, a substantial decrease compared to the operating period.

On the premises, however, the decommissioning will continue even after termination of electric power generation. NPP Temelín decommissioning can be performed in two basic ways - the so called immediate decommissioning or delayed decommissioning. In the case of immediate decommissioning all power plant structures will be decommissioned successively without time delays. In the case of delayed decommissioning, the disassembly of the structures with presence of radioactive contamination (the so called active structures) will be fully or partially delayed and these structures will be in a protective closing-down for approximately 30-50 years. The shutdown stage is the same for both types of decommissioning and during the stage when the spent fuel pond is in operation for approximately 5 years, the same nature of waste water like during NPP Temelín operation can be expected. It is expected that water management on this stage will be the same as during the normal operation and the same technologies will be used for the processing as during the NPP Temelín operation. A significant decrease in the annual amount of discharged water from the controlled area is expected (approximately as much as 10x less). During the next years of decommissioning, an increase in the annual amount of waste water can be expected, especially from decontamination of equipment and surfaces. The nature of water is again expected to be the same as during NPP Temelín operation. In the processing of waste water from decontamination and common operating waste water, the same technologies like those used in the processing of liquid waste from the controlled area will be used as during NPP Temelín operation (centrifugation, evaporation, bituminisation, cementation, possibly polymerisation). The discharged annual amount of water will increase compared to the shutdown stage, however, approximately a 3 to 6x lower annual amount compared to the normal NPP Temelín operation is expected. The higher amount of discharged water must be expected for the method of immediate decommissioning compared to delayed decommissioning. The discharges are not expected at the time of the protective close-down.

B.III.3. Waste

B.III.3.1. Period of operation

PROJECT (UNITS 3+4)

Amount:	municipal waste:	approximately 180 t/year
	inactive sludge:	approximately 110 t/year
	building and other waste:	approximately 350 t/year
	hazardous waste:	approximately 112 t/year

The estimate of the total average waste generation is based on the waste generation from the operation of the existing power plant. The following assumptions are considered: annual amount of hazardous waste (HW) from the existing and new units will be the same, municipal waste generation will be directly proportional to the number of employees in the location, the amount of inactive sludge will be directly proportional to the amount of treated water, amount of the waste in the “other” category will not exceed double today's average annual amount in the concurrence of the existing and new units.

Management:	municipal waste:	deposition
	inactive sludge:	deposition
	building and other waste:	recycling, deposition
	hazardous waste:	handing over to authorised persons

Waste disposal will be carried out in compliance with the act on wastes and with the management documents of ČEZ a. s. Like so far, the wastes will be collected at the previously specified collecting points and subsequently handed over for final disposal to specialised companies authorised to handle wastes, or to the waste dumping site in location no. 6 - Temelínec. The maximum effort will be paid to the reduction of waste dumping and use of the waste as secondary raw material.

The municipal waste will be deposited at the location no. 6 - Temelínec to the municipal waste dumping site with the capacity after the expansion sufficient for the construction of NPP Temelín 3, 4 and for the operation of NPP Temelín 1, 2, 3, 4 by 2080. The separation of waste will be carried out before deposition to location 6. The sludge from the power plant operation will be deposited to the inactive sludge lagoon in the northwestern part of location no. 6, which is sufficient in terms of the NNPP capacity.

Hazardous waste will be handed over to a person authorised for its acceptance in order to deposit it at the dumping site of the respective category.

The waste subject to buyout does not form the group of waste significant by the generation volume. However, this waste enters the regimen of sale and use directly, without the necessity of its further processing. This group includes selected waste from both the “other” and “hazardous” categories

Type: overview of generated waste in the operation

Table B.III.1: Types of waste generated in NNPP operation

Category	Type	Code
H	Waste paint and varnish containing organic solvents	08 01 11
H	Other waste paint and varnish containing organic solvents	08 01 12
H	Aqueous sludges containing paint or varnish other than those mentioned in 08 01 11	08 01 15
H	Wastes from paint or varnish removal	08 01 17
H	Water-based developer solutions	09 01 01
H	Fixer solutions	09 01 04
H	Machining emulsions and solutions free of halogens	12 01 09
H	Other hydraulic oils	13 01 13
H	Mineral-based non-chlorinated engine, gear and lubricating oils	13 02 05
H	Other engine, gear and lubricating oils	13 02 08
H	Mineral-based, non-chlorinated insulating and heat transmission oils	13 03 07
H	Oil from oil/water separators	13 05 06
H	Other halogenated solvents and solvent mixtures	14 06 02
H	Other solvents and solvent mixtures	14 06 03
O	Paper and cardboard packaging	15 01 01
O	Plastic packaging	15 01 02
H	Contaminated plastic packaging	
O	Metallic packaging	15 01 04
H	Contaminated metallic packaging	15 01 04
H	Packaging containing residues of or contaminated by dangerous substances	15 01 10
H	Metallic packaging containing a dangerous solid porous matrix (for example asbestos), including empty pressure containers	15 01 11
H	Absorbents, filter materials (including oil filters not otherwise specified)	15 02 02
O	End-of-life tyres	16 01 03
H	Discarded equipment containing hazardous components	16 02 13
O	Discarded equipment other than those mentioned in 16 02 09 to 16 02 13	16 02 14
H	Laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory chemicals	16 05 06
H	Lead batteries	16 06 01
H	Ni-Cd batteries	16 06 02
O	Wood	17 02 01
O	Plastic	17 02 03
O	Copper, bronze, brass	17 04 01
O	Aluminium	17 04 02
O	Iron and steel	17 04 05
O	Cables other than those mentioned in 17 04 10	17 04 11
O	Concrete	17 01 01
O	Glass	17 02 02
O	Bricks	17 01 02
O	Tiles and ceramics	17 01 03
O	Mixtures of concrete, bricks, tiles and ceramics	17 01 07
O	Soil and stones (non-contaminated)	17 05 04
O	Insulation materials other than those mentioned in 17 06 01 and 17 06 03	17 06 04
O	Stabilised sludge	19 06 01
O	Sludges from water clarification	19 09 02
O	Saturated or spent ion exchange resins	19 09 05
O	Paper and cardboard	20 01 01
O	Glass	20 01 02
O	Textiles	20 01 11
H	Fluorescent tubes and other mercury-containing waste	20 01 21
O	Edible oil and fat	20 01 25
O	Mixed municipal waste	20 03 01

The list is based on Decree no. 381/2001 Coll., that specifies the Waste Code. The composition of wastes will be the same as for the existing state of NPP Temelín. They will include the hydraulic, motor, gear and lubricating oils, waste paint and varnish, metallic packaging, lead batteries, discarded inorganic chemicals, metal, plastic, paper, insulating material, sludges, fluorescent tubes, laboratory chemicals, mixed building and demolition waste, municipal waste etc.

In the controlled area, also common inactive wastes are generated; however, they can be introduced to the environment[1] only after dosimetric control and SONS approval (Section 57 paragraph 3 of Act no. 307/2002 Coll.). These wastes are collected at the collecting points to the marked baskets (or other containers appropriate for the nature of the waste). If the subsequent dosimetric control shows that the waste is really inactive, the waste is released into the environment based on the SONS permit and it is further handled in accordance with the act on wastes.

The data regarding the radioactive waste from the controlled area (radionuclide composition, activity levels, amount) are specified in Chapter B III.4. (page 208 in this documentation).

PLANT (UNITS 1+2+3+4)

Amount:	municipal waste:	approximately 300 t/year
	inactive sludge:	approximately 297 t/year
	building and other waste:	approximately 700 t/year
	hazardous waste:	approximately 224 t/year

For the amount of power plant waste after the expansion (units 1+2+3+4) similar assumptions apply as specified above for the project (units 1+2).

Management:	municipal waste:	deposition
	inactive sludge:	deposition
	building and other waste:	recycling, deposition
	hazardous waste:	handing over to authorised persons

For the handling of power plant waste after the expansion (units 1+2+3+4) the method specified above for the project (units 3+4) will apply.

Type:	overview of generated waste:	meets the project

The list of wastes from the power plant after the expansion (units 1+2+3+4) matches the list specified above for the project (units 1+2).

B.III.3.2. Preparation and implementation period

Amount:	other waste - building:	approximately 350,000 t
	other waste - municipal:	approximately 4950 t
	hazardous waste:	approximately 735 t

Based on the experience from the existing NPP Temelín construction, the generation of a rather huge amount of building waste can be expected from the evacuation of the NNPP construction site (demolitions, relaying of utilities etc.) at the beginning of the construction stage. On the construction stage, the generation of building waste will decrease. A significant increase in building waste can be expected again at the end of the construction when the structures of site facilities will be disposed of.

Handling:	other waste - building:	recycling, deposition
	other waste - municipal:	deposition
	hazardous waste:	handing over to authorised persons

Waste generation during the construction period will be kept to a minimum. The use of prefabricated halls for the construction of site facilities will be preferred and the reduction of the use of the substances, that disable the subsequent recycling, will be required (this applies mainly to hazardous substances). During the building and demolition works, the emphasis will be placed on the systematic separation of contaminated materials in order to avoid the impairment of the material designed for recycling.

Building waste will have the majority share in the total amount of the generated waste (up to 98%). The substantial group of wastes will consists of the inert materials for proper treatment using recycling technologies to the secondary building material which will have priority use at the NNPP construction site, e.g. in production of subconcrete, in the road base courses, for filling non-structural concrete (non-technological structures), for fills and subbases of utilities, hardening and modifications of surfaces, for areas and structures of site equipment etc. (all in compliance with Decree no. 294/2005 Coll., as amended, Act no. 22/1997 Coll., as amended and other related regulations). For the recycling of building waste, the recycling line, located in the area of construction, possibly in the area of site facilities, will be used. For the storage of generated building material, the intermediate deposit in the area of site facilities will be built. The use of the building material from the recycled building waste will depend on the progress of works during construction. The excess may be sold to places where it can be used as building material, possibly for cleaning up environmental burdens (MAPE Mydlovary) etc. Despite all above-mentioned measures, it is expected that all building waste will not be possible to recycle and approximately 25% of

[1] The term "introduced into the environment" is based on Decree no. 307/2002 Coll., on radiation protection, and it practically means that these wastes from the controlled area are not subject to the Nuclear Act, however they have to be handled in accordance with the Act on Wastes no. 185/2001 Coll.

the generated waste will be deposited at the dumping site that is situated at the existing location 6 - Temelínec.

In handling the "other" waste category (municipal nature) the principle of separation of materials will be preferentially applied so that they can be used as secondary raw material (paper, plastic, glass etc.) to the maximum extent. Only the materials that cannot be used that way, will be disposed of in a professional way. The existing location no. 6 - Temelínec is designed for the deposition of municipal waste; its capacity after the already previously planned stage expansion will be sufficient for the construction of NPP Temelín 3, 4 and for the operation of NPP Temelín 1, 2, 3, 4 by 2080. Waste separation will be performed before its deposition at location no. 6.

The expected amount of the "hazardous" waste category makes a very small amount of the total generated waste (approximately 0.21%). Hazardous waste will be handed over to a person authorised for its acceptance in order to deposit it at the dumping site of the respective category. The distance of proper hazardous waste dumping sites is approximately 16-20 km from NPP Temelín.

The waste subject to buyout does not form the group of waste significant by the generation volume (approximately 0.26% of the total generated waste). However, this waste enters the regimen of sale and use directly, without the necessity of its further processing. This group includes selected waste from both the "other" and "hazardous" categories

Type: overview of generated waste in the construction period:

Table B.III.2: Types of waste generated in NNPP construction

Category	Type	Code
O	Steel - disassembled equipment and structures, reinforcement	17 04 05
O	Brass	17 04 01
O	Aluminium	17 04 02
O	Waste cables	17 04 11
O	Concrete	17 01 01
O	Glass	17 02 02
O	Bricks	17 01 02
O	Tiles and ceramics	17 01 03
O	Mixtures of concrete, bricks, tiles and ceramics	17 01 07
O	Soil and stones (non-contaminated)	17 05 04
O	Insulation of piping	17 06 04
H	Soil polluted with petroleum substances	05 01 99
H	Waste paint and varnish containing organic solvents or other hazardous substances	08 01 11
H	Oils	13 01 03
O,H	Wastes from electric and electronic equipment	16 02 ..
H	Mixtures or separated fractions of concrete, bricks, tiles and ceramic items containing dangerous substances	17 01 06
H	Soil and stones containing dangerous substances	17 05 03
O	Paper and cardboard	20 01 01
O	Mixed municipal waste	20 03 01

The list is based on Decree no. 381/2001 Coll., that specifies the Waste Code.

B.III.3.3. Shutdown period

Amount:

other waste - building:	approximately 662,400-1,440,000 t
other waste - municipal:	approximately 6,000-12,000 t
other waste - metallic:	approximately 92,000-200,000 t
hazardous waste:	approximately 2000-3000 t

In the process of NPP decommissioning, the inactive waste will be generated; initially of the same nature as during the normal operation, later during the disassembling and demolition activities, its type distribution will change and the amount of building waste will increase. The building waste (the specified amount is based on the bulk density of waste approximately 1.8 t/m^3) and metallic waste consisting of the building steel structures including the concrete reinforcement and metallic waste from disassembled inactive technology will prevail. Inactive waste will further be generated in the disassembly of inactive technological systems (outside the controlled area) and demolitions of inactive structures and the structures of the nuclear island after entire contamination has been eliminated.

Handling:

other waste - building:	recycling, deposition
other waste - municipal:	deposition
other waste - metallic:	recycling
hazardous waste:	handing over to authorised persons

Building waste will have the majority share in the total amount of the generated waste. The substantial group of waste will consist of inert materials proper for the treatment using recycling technologies to the secondary building material that will have priority use during the building activity in the power plant neighbourhood. It includes mainly concrete, bricks, some ceramic materials etc. The amount of such used building waste cannot be currently estimated due to long time interval. The recycling line, possibly recycling centres in the neighbourhood of the power plant, will be used for building waste recycling. The waste that will not be possible to recycle, will be deposited to the dumping sites in the vicinity of the power plant. It includes e.g. elevated floors, roof heat insulation, suspended ceilings, watertight insulation, flooring, sanitary equipment, etc.

For the "other" waste category of municipal nature, the principle of separation of materials will be preferentially applied so that they can be used as secondary raw material (paper, plastic, glass etc.) to the maximum extent. Only the materials that cannot be used that way, will be disposed of in a professional way. The existing location no. 6 - Temelínec is designed for the municipal waste deposition. If the capacity of the municipal waste dumping site in this location is already exhausted, the municipal waste will be handed over to a company authorised to dispose and handle waste. Waste separation will be performed before its deposition to location no. 6 or before handing over to the authorised company.

During the disassembly and demolitions, a small share of hazardous waste will also be generated, which will be handed over to a person authorised for its acceptance in order to deposit it at the dumping site of the respective category.

The waste subject to the buyout includes the selected waste from both the "other" and "hazardous" categories. Larger amounts of the waste belonging to this group will be generated mainly during the disassembly of the power plant technological equipment. It includes iron, steel, some types of cables and lead batteries.

B.III.4. Other

B.III.4.1. Radioactive discharges into air

B.III.4.1.1. Period of operation

PROJECT (UNITS 3+4)

Sources: technological systems, gaseous waste processing system, air-conditioning systems with the presence of radionuclides in the air, air-conditioning systems of active operations

The gaseous waste processing system is operated continuously during normal NPP operation. For the most of time during NPP operation at full capacity, the system functions in the stabilised mode with the constant flow rate of the cleaning system and small constant discharges from the delay lines.

Location: ventilation stacks of MGU, machine halls and auxiliary operations

Amount and radionuclide composition:

2x1200 MW_e power alternative:

Table B.III.3: Annual emissions into the air from 2 NNPP Temelín units, power alternative 2x1200 MW_e

Radionuclide	Discharges from 2 units [Bq/year]	Radionuclide	Discharges from 2 units [Bq/year]
H-3	2.59E+13	Ru-106	5.77E+06
C-14	5.40E+11	Sb-125	4.51E+06
Ar-41	2.52E+12	I-131	8.88E+09
Cr-51	4.51E+07	I-133	2.96E+10
Mn-54	3.18E+07	Xe-131m	1.33E+14
Fe-59	5.85E+06	Xe-133m	6.44E+12
Co-58	1.70E+09	Xe-133	3.40E+14
Co-60	6.44E+08	Xe-135m	5.18E+11
Kr-85m	2.66E+12	Xe-135	2.44E+13
Kr-85	3.04E+14	Xe-137	0.00E+00
Kr-87	1.11E+12	Xe-138	4.44E+11
Kr-88	3.40E+12	Cs-134	1.70E+08
Sr-89	2.22E+08	Cs-136	6.29E+06
Sr-90	8.88E+07	Cs-137	2.66E+08
Zr-95	7.40E+07	Ba-140	3.11E+07
Nb-95	1.85E+08	Ce-141	3.11E+06
Ru-103	5.92E+06		

The table gives the design annual discharges from 2 NNPP units.

2x1700 MW_e power alternative:

Table B.III.4: Annual emissions into the air from 2 NNPP Temelín units, power alternative 2x1700 MW_e

Radionuclide	Discharges from 2 units [Bq/year]	Radionuclide	Discharges from 2 units [Bq/year]
H-3	1.33E+13	Ru-106	5.77E+04
C-14	5.40E+11	Sb-125	4.51E+04
Ar-41	2.52E+12	I-131	6.51E+08
Cr-51	7.18E+06	I-133	2.37E+09
Mn-54	4.22E+06	Xe-131m	2.59E+14
Fe-59	2.08E+06	Xe-133m	1.33E+13
Co-58	3.55E+07	Xe-133	6.36E+14
Co-60	8.14E+06	Xe-135m	1.04E+12
Kr-85m	1.11E+13	Xe-135	8.88E+13
Kr-85	2.52E+15	Xe-137	0.00E+00
Kr-87	3.92E+12	Xe-138	8.88E+11
Kr-88	1.33E+13	Cs-134	3.55E+06
Sr-89	1.18E+07	Cs-136	2.44E+06
Sr-90	4.66E+06	Cs-137	6.66E+06
Zr-95	7.40E+05	Ba-140	3.11E+05
Nb-95	3.11E+06	Ce-141	9.62E+05
Ru-103	1.26E+06		

The table gives the design annual discharges from 2 NNPP units.

PLANT (UNITS 1+2+3+4)

Sources: technological systems, gaseous waste processing system, air-conditioning systems with the presence of radionuclides in the air, air-conditioning systems of active operations

Location: ventilation stacks of MGU, machine halls and auxiliary operations

Amount and radionuclide composition:

To obtain the values of total discharges from the power plant after the expansion, the data regarding the existing NPP Temelín discharges must be added to the above-specified data for the NPPP discharges .

Existing plant 2×1000 MW_e

Table B.III.5: Annual emissions into the air from 2 NPP Temelín units, power 2x1000 MW_e, design values

Radionuclide	Discharges from 2 units [Bq/year]	Radionuclide	Discharges from 2 units [Bq/year]
H-3	2.51E+13	I-131	7.45E+08
C-14	6.61E+11	Te-132	3.20E+06
Na-24	8.90E+05	I-132	1.66E+08
Ar-41	2.15E+12	I-133	1.13E+09
K-42	2.15E+07	I-134	9.00E+07
Cr-51	4.23E+05	I-135	6.10E+08
Fe-55	1.79E+05	Xe-133	1.23E+15
Co-60	1.06E+04	Xe-135m	2.52E+11
Ni-63	1.43E+04	Xe-135	1.88E+13
Kr-85m	1.92E+12	Xe-138	1.26E+11
Kr-85	2.41E+14	Cs-134	3.90E+06
Kr-87	1.92E+13	Cs-137	9.12E+06
Kr-88	4.98E+13		

The table gives the design values of discharges for 2 units of the existing power plant with approximately 2x1000 MW_e power. It is the summary value of discharges from both units including discharges from both machine halls as well as the active auxiliary operations building.

Since the results of power plant operation monitoring are available, the results of measured value of discharges are also shown in addition to the design data:

Table B.III.6: Annual emissions into the air from 2 NPP Temelín units, power 2x1000 MW_e, measured values

Radionuclide	Discharges from 2 units [Bq/year]	Radionuclide	Discharges from 2 units [Bq/year]
H-3	3.70E+12	Sb-124	1.50E+06
C-14	5.60E+11	Sb-125	2.50E+05
Ar-41	1.40E+12	I-131	2.40E+08
Cr-51	6.00E+06	Te-132	4.20E+05
Mn-54	2.70E+05	I-133	6.70E+06
Fe-59	9.80E+04	Xe-133	5.70E+12
Co-58	1.60E+06	Xe-135m	7.30E+10
Co-60	5.00E+05	Xe-135	1.70E+12
Zn-65	8.80E+04	Xe-138	3.30E+10
Kr-85m	2.40E+11	Cs-134	6.10E+05
Kr-85	2.50E+11	Cs-137	6.20E+05
Kr-87	1.70E+11	Ba-140	1.90E+05
Kr-88	4.30E+11	Ce-141	6.80E+04
Sr-89	3.80E+05	Ce-144	2.70E+05
Sr-90	1.70E+05	Pu-238	5.20E+04
Zr-95	6.90E+05	Pu-239	3.30E+04
Nb-95	1.10E+06	Am-241	2.10E+04
Ag-110m	6.70E+05		

The table gives the maximums from the measured values of the discharges for individual radionuclides from NPP Temelín (both generation units as well as the active auxiliary operations building). For individual radionuclides, this maximum is used from the values measured in 2004-2008. The year 2003 is not taken into consideration, since unit 2 was still in the trial run in that year.

B.III.4.1.2. Preparation and implementation period

Construction: without additional outputs

No radionuclides will be released into the air during project preparation and implementation (construction and erection work).

Construction will be carried out simultaneously with the operation of the two existing power plant units, its air discharges will not change in any way as a result of the project.

B.III.4.1.3. Shutdown period

Shutdown stage:

noble gases and aerosols: decrease by approximately 3 orders of magnitude, to approximately 10^{12} to 10^{13} Bq/year

Tritium: decrease approximately 10x, to approximately 10^{12} Bq/year

Iodines: decrease by approximately 4 orders of magnitude, to approximately 10^{6} Bq/year

^{14}C: decrease approximately 10x, to approximately 10^{11} Bq/year

On the shutdown stage as a result of the shutdown of the nuclear power plant units, the discharges of noble radioactive gases into the atmosphere will decrease significantly compared to normal NPP operation. Out of four basic operational sources of contamination of air masses (core circuit blow-off, vaporisation from the equipment and liquid leaks to the controlled area rooms, secondary circuit blow-off, air activation in the reactor shaft) only vaporisation from liquid radioactive media will practically apply, mainly from the spent fuel ponds. After the removal of spent nuclear fuel from the SFP and processing of SFP water, this source will no longer apply either.

Gaseous RAW are conducted like during normal operation to the air-conditioning system filters, where the radioactive aerosols are separated with high efficiency.

The values of the activities of radionuclides discharged into the air were set using expert estimates; the short-time nuclides dominating to the conditions of normal operation are not included.

Other decommissioning stages:

noble gases and aerosols: decrease by approximately 2 orders of magnitude, to approximately 10^{10} to 10^{11} Bq/year

Tritium:	decrease by approximately 2 orders of magnitude, to approximately 10^{10} Bq/year
Iodines:	decrease by approximately 1 to 2 orders of magnitude, to approximately 10^{4} to 10^{5} Bq/year
^{14}C:	decrease by approximately 1 to 2 orders of magnitude, to approximately 10^{9} to 10^{10} Bq/year

On the other decommissioning stages, further decrease of activities can be expected compared to the shutdown stage.

The source of environmental contamination on other decommissioning stages include the decontamination and disassembling activities and the operation of RAW processing technologies (fragmentation), where radioactive aerosols are created in a higher amount. Disassembling activities and RAW processing technologies will be safeguarded in order to provide as low an aerosol leakage as possible.

Gaseous RAW will be conducted like during the normal operation to the air-conditioning system filters, where the radioactive aerosols are separated with high efficiency. Under these conditions it can be expected that the released radioactivity into the atmosphere will even decrease significantly compared to the shutdown stage.

The values of the activities of radionuclides discharged into the air were set using expert estimates; the short-time nuclides dominating to the conditions of normal operation are not included.

The specifying of the data regarding radioactivity and radionuclide composition of discharges into the atmosphere will be the subject of the documentation “Design of the NPP decommissioning method”, which must be prepared before the start of the NPP operation and is updated every 5 years.

B.III.4.2. Radioactive discharges into watercourses

B.III.4.2.1. Period of operation

PROJECT (UNITS 3+4)

Sources: waste water treatment systems

Service waste water is treated in the waste water treatment systems where the radioactive substances are concentrated to the smallest volume possible. That way, the relatively small amount of the medium that can be labelled as RAW is generated on one hand, as well as the relatively large amount of the treated medium for further use on the other hand. The treated medium is used for the purposes of the NPP process systems. In the case that the withdrawal to the process systems is small, this water is discharged as over-balance outside the NPP premises. If the withdrawal to the service systems is higher, demineralised water is used to replenish the required volume.

The treated waste water is collected in the examination reservoirs. Radiochemical inspection of the medium in those reservoirs determines how the water will be handled. Only the water that meets the release levels may be discharged to the environment. If the water has higher levels of activity, it is repumped back for the retreatment.

Volume activity of treated waste water is caused mainly by ^{3}H (tritium) radionuclide, which cannot be retained using the treatment system. The concentration limit for tritium will be achieved by organised discharge (dilution with the total amount of all waste water, discharged from the power plant). Another limiting factor for the discharge into the environment is the value of volume activity ß.

Discharged volume: 15,000-50,000 m^3/year

Receiving water: the Vltava River, Kořensko segment

Radionuclide composition:

2x1200 MW_e power alternative:

Table B.III.7: Annual discharges to watercourses from 2 NPP Temelín units, power alternative 2x1200 MW_e

Radionuclide	Discharges from 2 units [Bq/year]	Radionuclide	Discharges from 2 units [Bq/year]
Na-24	1.2E+08	Te-129	1.1E+07
Cr-51	1.4E+08	Te-131m	6.7E+06
Mn-54	9.6E+07	Te-131	2.2E+06
Fe-55	7.4E+07	I-131	1.0E+09
Fe-59	1.5E+07	Te-132	1.8E+07
Co-58	2.5E+08	I-132	1.2E+08
Co-60	3.3E+07	I-133	5.0E+07
Zn-65	3.0E+07	I-134	6.0E+07
Br-84	1.5E+06	Cs-134	7.4E+08
Rb-88	2.0E+07	I-135	3.7E+08
Sr-89	7.4E+06	Cs-136	4.7E+07
Sr-90	7.4E+05	Cs-137	9.8E+08
Sr-91	1.5E+06	Ba-137m	9.3E+08
Y-91m	7.4E+05	Ba-140	4.1E+08
Y-93	6.6E+06	La-140	5.5E+08
Zr-95	1.7E+07	Ce-141	6.7E+06
Nb-95	1.6E+07	Ce-143	1.4E+07
Mo-99	4.2E+07	Pr-143	9.6E+06
Tc-99m	4.1E+07	Ce-144	2.3E+08
Ru-103	3.6E+08	Pr-144	2.3E+08
Rh-103m	3.6E+08	W-187	9.6E+06
Ru-106	5.4E+09	Np-239	1.8E+07
Rh-106	5.4E+09	others total	1.5E+06
Ag-110m	7.8E+07		
Ag-110	1.0E+07	Total discharges (without tritium)	1.9E+10
Te-129m	8.9E+06	Tritium	7.5E+13

The table gives the design annual discharges from 2 NNPP units.

2x1700 MW_e power alternative:

Table B.III.8: Annual discharges into watercourses from 2 NNPP Temelín unitsf, power alternative 2x1700 MW_e

Radionuclide	Discharges from 2 units [Bq/year]	Radionuclide	Discharges from 2 units [Bq/year]
Na-24	3.5E+08	Ag-110m	1.3E+08
P-32	1.3E+07	Ag-110	5.3E+06
Cr-51	4.4E+08	Sb-124	3.2E+07
Mn-54	3.3E+08	Te-129m	5.8E+06
Fe-55	5.7E+08	Te-129	2.3E+07
Fe-59	1.7E+08	Te-131m	1.9E+07
Co-58	7.3E+08	Te-131	5.6E+06
Co-60	1.0E+09	I-131	1.5E+08
Ni-63	1.3E+08	Te-132	3.5E+07
Zn-65	1.6E+07	I-132	2.3E+07
W-187	2.6E+07	I-133	6.0E+07
Np-239	3.9E+07	I-134	6.6E+06
Rb-88	2.1E+09	Cs-134	8.9E+08
Sr-89	1.1E+07	I-135	5.8E+07
Sr-90	1.3E+06	Cs-136	1.6E+09
Sr-91	5.0E+06	Cs-137	1.3E+09
Y-91m	3.3E+06	Ba-137m	3.4E+07
Y-91	6.7E+06	Ba-140	4.3E+08
Y-93	2.1E+07	La-140	5.9E+08
Zr-95	9.6E+07	Ce-141	2.1E+07
Nb-95	1.5E+08	Ce-143	3.7E+07
Mo-99	1.3E+08	Pr-143	5.8E+06
Tc-99m	1.3E+08	Ce-144	4.1E+08

Ru-103	2.5E+08	Pr-144	1.3E+08
Rh-103m	2.3E+08	others total	8.9E+05
Ru-106	3.5E+09	Total discharges (without tritium)	1.9E+10
Rh-106	2.9E+09	Tritium	1.2E+14

The table gives the design annual discharges from 2 NNPP units.

PLANT (UNITS 1+2+3+4)

Sources: waste water treatment systems

Discharged volume: 33,000-80,000 m^3/year

Receiving water: the Vltava River, Kořensko segment

Radionuclide composition:

To obtain the values of total discharges from the power plant after the expansion, the data regarding the existing NPP Temelín discharges must be added to the above-specified data for the NPPP discharges.

Existing plant 2×1000 MW_e

Table B.III.9: Annual discharges into watercourses from 2 NPP Temelín units, power 2x1000 MW_e, design values

Radionuclide	Discharges from 2 units [Bq/year]	Radionuclide	Discharges from 2 units [Bq/year]
C-14	1.43E+06	Ni-63	2.26E+06
Cr-51	1.05E+07	I-131	2.09E+07
Mn-54	2.15E+06	Cs-134	4.57E+06
Fe-55	2.53E+07	Cs-137	1.10E+07
Co-58	2.15E+06	Total discharges (without tritium)	8.47E+07
Co-60	1.65E+06	Tritium	1.65E+13

The table gives the design values of discharges for 2 units of the existing power plant with approximately 2x1000 MW_e power. Only the nuclides that show higher contributions to the Vltava than 10^6 Bq/year, are mentioned.

Since the results of power plant operation monitoring are available, the results of measured values of discharges are also shown in addition to the design data:

Table B.III.10: Annual discharges to watercourses from 2 NPP Temelín units, power 2x1000 MW_e, measured values

Radionuclide	Discharges from 2 units [Bq/year]	Radionuclide	Discharges from 2 units [Bq/year]
Cr-51	3.5E+05	Sb-125	< DL
Mn-54	3.8E+06	I-131	1.8E+07
Fe-55	< DL	Cs-134	1.2E+08
Fe-59	< DL	Cs-137	1.3E+08
Co-58	9.0E+05	Ba-140	< DL
Co-60	2.2E+06	La-140	< DL
Ni-63	< DL	Ce-141	< DL
Zn-65	< DL	Ce-144	< DL
Sr-89	1.5E+06	Pu-238	7.4E+05
Sr-90	3.7E+05	Pu-239+Pu-240	5.0E+05
Zr-95	7.5E+06	Am-241	4.0E+05
Nb-95	1.9E+07	Cm-242	< DL
Ru-103	3.4E+04	Cm-243	< DL
Ru-106	< DL	Cm-244	< DL
Ag-110m	1.9E+07	Total discharges (without tritium)	3.1E+08
Sb-124	3.7E+07	Tritium	5.4E+13

Note: If the measured value is below MDA, it is not included in the balances (marked < DL)

The table gives the maximums from the measured values of the discharges for individual radionuclides from NPP Temelín (both generation units). For individual radionuclides this maximum is used from the values measured between 2006-2008.

B.III.4.2.2. Preparation and implementation period

Construction: without additional outputs

No radionuclides will be released into the watercourses during project preparation and implementation (construction and erection work).

Construction will be carried out simultaneously with the operation of the two existing power plant units, its watercourse discharges will not change in any way as a result of the project construction.

B.III.4.2.3. Shutdown period

Shutdown stage:

total activity (without tritium): decrease by approximately 3 to 4 orders of magnitude, to approximately 10^6 to 10^7 Bq/year

Tritium: decrease approximately 10x, to approximately 10^{13} Bq/year

Like during the normal operation the discharged water will be monitored and the discharge will be regulated in order to avoid exceeding the specified concentration and balance limits. On the shutdown stage it can be assumed that the summary activity without tritium will be approximately 3 to 4 orders lower than during the normal operation and the main radionuclides will be ^{137}Cs, ^{134}Cs, ^{55}Fe, ^{60}Co, ^{63}Ni. The summary tritium activity is expected to be approximately 10x lower than during the normal operation, its level is determined mainly by the processing of water from the SNF pond.

The activity levels of radionuclides discharged into watercourse are based on the expert estimates considering the following assumptions: short-time nuclides dominating to the conditions of normal operation are not included, in the case of tritium not only natural decay but also gradual wash from the media and materials inside the active structures are considered.

Other decommissioning stages:

total activity (without tritium): decrease by approximately 1 to 2 orders of magnitude, to approximately 10^4 to 10^6 Bq/year

Tritium: decrease approximately 10x, to approximately 10^{12} Bq/year

The sources of environmental contamination on other decommissioning stages include the decontamination and disassembling activities and the operation of RAW processing technologies (fragmentation), where radioactive aerosols are created in a higher amount and radionuclides mainly from the inside surfaces of the contaminated process equipment are released to liquid RAW during decontamination. Disassembling activities and RAW processing technologies will be safeguarded in order to provide as low radionuclide leakage as possible.

Contaminated water will pass through the system of treatment plants and examination reservoirs. The discharged water will be monitored and the discharge will be regulated in order to avoid exceeding the specified concentration and balance limits. It can be assumed that the summary activity without tritium will even be approximately 1 to 2 orders lower than during the shutdown stage and the main radionuclides will be ^{137}Cs, ^{134}Cs, ^{55}Fe, ^{60}Co, ^{63}Ni. The summary tritium activity is expected to be even approximately 10x lower than during the shutdown stage.

The values of the activities of radionuclides discharged into the watercourse are based on expert estimates considering the assumption that the short-time nuclides dominating the conditions of normal operation are not included.

The specifying of the data regarding radioactivity and radionuclide composition of discharges into watercourses, will be the subject of the documentation “Design of the NPP decommissioning method”, which must be prepared before the start of the NPP operation and is updated every 5 years.

B.III.4.3. Ionising radiation field

B.III.4.3.1. Period of operation

PROJECT (UNITS 3+4)

Sources, activity: insignificant

Ionising radiation field in this case means the impact of electromagnetic (gamma) radiation possibly neutrons directly from power plant process structures (without contribution of discharges). This assumption is based on the results of monitoring of the dose equivalent input on the premises of the existing power plant, where no difference was detected between the period before and after the power plant launch. The results are included in Section D.I.3.3. Effects of ionising radiation (this document, page 407).

PLANT (UNITS 1+2+3+4)

Sources, activity: insignificant

Ionising radiation field in this case means the impact of electromagnetic (gamma) radiation possibly neutrons directly from power plant process structures (without contribution of discharges). This assumption is based on the results of monitoring of the dose equivalent input on the premises of the existing power plant, where no difference was detected between the period before and after the power plant launch. The results are included in Section D.I.3.3. Effects of ionising radiation (this document, page 407).

B.III.4.3.2. Preparation and implementation period

Sources, activity: insignificant

During the construction period the use of certain devices based on the use of ionising radiation (e.g. X-ray materiology devices) cannot be excluded. Those will always be approved devices, used in compliance with their terms of operation, without significant outputs.

B.III.4.3.3. Shutdown period

Sources, activity: insignificant

They will not exceed the outputs during the period of operation.

B.III.4.4. Radioactive waste

B.III.4.4.1. Period of operation

PROJECT (UNITS 3+4)

Sources: filters of active air-conditioning systems, activated measuring sensors and cartridges of control samples, various objects after contact with active media

Solid radioactive waste is generated depending on the reactor operating mode, mainly during regular shutdowns, maintenance and cleaning works, decontamination of equipment and rooms etc. The contact with active media, mainly the core circuit water, is the source of contamination of various objects (clothes, protective equipment, defective further unusable parts of the equipment etc.). In addition to this randomly, possibly irregularly generated waste, the regular waste generation from the filters of active air-conditioning systems, activated measuring sensors and cartridges with control samples is expected. Besides such so called small RAW, the generation of so called bulk RAW must be sporadically taken into consideration. The product created in the treatment of liquid RAW, e.g. by fixation to a matrix or exsiccation, may be included among solid RAW.

Note: Spent/irradiated nuclear fuel is not waste.

Amount and radionuclide composition:

total volume: 50-70 m^3/1000 MW a year

The goal of RAW management is to minimise its volume for deposition on one hand. Therefore such technologies will be used for RAW processing and treatment that will ensure both maximum reduction of waste for deposition possible and also the minimum radiation dose to the staff.

Radionuclide composition of activity of the contaminated solid waste will depend on the nature of contamination: in the case of waste contaminated directly by water from core circuit ^{137}Cs and ^{134}Cs will prevail, in the case of waste contaminated implicitly through the deposit in the equipment (during maintenance) ^{58}Co, ^{60}Co a ^{54}Mn prevail. The source of the HVAC-filter activity includes the radioactive aerosols with higher content of volatile components trapped from the process blow-off and from ventilation of rooms with possible leak of radioactive media. For the activity of treated liquid waste, the primary source element includes the water from core circuit, where radionuclides are present both in soluble and insoluble form (mainly the corrosion products).

Handling: deposition to RAWR Dukovany

Radioactive waste will be deposited (in compliance with the Policy of Radioactive Waste Management and Spent Fuel Management in the Czech Republic) at the RAWR Dukovany. All treated wastes must meet the conditions of acceptability to the repository, which is also the limiting factor for the selection of RAW treatment technology.

PLANT (UNITS 1+2+3+4)

Sources: filters of active air-conditioning systems, activated measuring sensors and cartridges of control samples, various objects after contact with active media

Amount and radionuclide composition:

total volume: 50-70 m^3/1000 MW a year

Handling: deposition to RAWR Dukovany

Sources of waste, amount (related to the power), radionuclide composition and waste management will meet the existing power plant practice.

B.III.4.4.2. Preparation and implementation period

Construction: without additional outputs

No radioactive waste will be generated during project preparation and implementation (construction and erection work).

Construction will be carried out simultaneously with the operation of the two existing units of the power plant, its radioactive waste generation will not change in any way as a result of the project.

B.III.4.4.3. Shutdown period

Shutdown stage:

2x1200 MW_e power alternative:

treated RAW for RAWR: approximately 274 m^3
treated RAW for deep repository: 0 m^3

2x1700 MW_e power alternative:

treated RAW for RAWR: approximately 440 m^3
treated RAW for deep repository: 0 m^3

Other decommissioning stages:

2x1200 MW_e power alternative:

treated RAW for RAWR: approximately 4,490-4,670 m^3
treated RAW for deep repository: approximately 833-882 t

2x1700 MW_e power alternative:

treated RAW for RAWR: approximately 7,200-7,500 m^3
treated RAW for deep repository: approximately 1,350-1,450 t

The NPP state before the start of decommissioning in terms of radiation situation depends on performing the activities during the normal NPP operation, on the quality of staff, conformance to regulations, approach to provide RAW minimisation etc. Radiation situation on the nuclear power plant premises at the time of reactor shutdown is given by the amount of radioactive materials present in individual technological systems, radionuclide composition of deposed activity as well as its physical and chemical form.

Solid RAW generated during decommissioning is expected to be handled in a similar way as like during normal operation. On the shutdown stage and other stages of immediate decommissioning, the technologies of RAW processing and treatment used during the operation will be used. During the delayed decommissioning, it will be necessary to use new technologies at the time of disposal that will be optimally applicable for various types of generated RAW at that time.

The main goal of decommissioning activities is to remove contamination from process systems which is accumulated on their inside surfaces as well as the building part surfaces as a result of the operation.

Using the technologies of RAW separation, processing and treatment, the fixation of radionuclides into the form acceptable for reposition and transport to the place of reposition must be provided. During the whole process the emphasis will be placed on maximum separation of potentially inactive waste from the controlled area, in order to minimise the amount of waste to be reposed in the repositories.

Handling RAW from decommissioning will be carried out using proper technological procedures for RAW processing and treatment, which will ensure its safe reposition. The final form of treated RAW must conform to then applicable conditions of acceptability to RAWR Dukovany, possibly the conditions of acceptability to another, then established surface repository. In accordance with the current prognoses of RAW balances it may be assumed that the current RAWR Dukovany will also accommodate the waste from the new Temelín nuclear units operation, however, there may be difficulties with reposition of the waste from their decommissioning. Although it was designed at a time when further development of nuclear power engineering was impossible to foresee (number of new nuclear power plants), the spare space was still assumed for its future expansion.

The waste from decommissioning will be impossible to place into the surface repository, so it will be placed into the deep repository which is expected to be launched based on the “Policy of Radioactive Waste Management and Spent Fuel Management in the Czech Republic” after 2065.

B.III.4.5. Spent nuclear fuel

B.III.4.5.1. Period of operation

PROJECT (UNITS 3+4)

Sources: reactor cores

The reactor cores, from which the used fuel sets are removed during the fuel replacement to the spent fuel pond which is located in the vicinity of the reactors, are the source of spent (possibly irradiated) nuclear fuel.

Amount:
power alternative 2x1200 MW_e: approximately 43.5-48.0 t UO_2/year (for 2 units)
power alternative 2x1700 MW_e: approximately 72.0-78.5 t UO_2/year (for 2 units)

The amount of spent nuclear fuel removed from reactors matches the amount of fresh fuel in the charge.

Handling: storage, deposition

The spent (possibly irradiated) nuclear fuel is removed from the reactor core to the spent fuel storage pond where it is stored for the time necessary to reduce the power of the residual heat. After the period of time necessary for the reduction of the power of the residual heat, the fuel is transferred to special package sets and moved to the spent nuclear fuel repository on the power plant premises.

Spent nuclear fuel is not waste. Any spent nuclear fuel that will be generated during NNPP operation will be stored on the NPP Temelín premises. If declared as radioactive waste, it will be transferred to the deep repository.

The above-specified method of handling (i.e. the long-term storage and following reposition in the deep repository) is in accordance with the “Policy of Radioactive Waste Management and Spent Fuel Management” and represents the basic national strategy in spent nuclear fuel management.

PLANT (UNITS 1+2+3+4)

Sources: reactor cores

Amount: approximately 89.5-124.5 t UO_2/year (for 2 units)

Handling: storage, deposition

The sources of spent nuclear fuel and the method of handling the spent nuclear fuel will be in conformance with the existing practice in the power plant and the policy of radioactive waste management and spent fuel management adopted by the government. The amount will match the total NNPP and NPP Temelín generation.

B.III.4.5.2. Preparation and implementation period

Sources, amount: no generation

At the period of project preparation and implementation, the spent nuclear fuel will not be generated. The generated amount from the existing NPP Temelín (approximately 46 t UO_2/year) will not be affected.

B.III.4.5.3. Shutdown period

Sources, amount: no generation

During the shutdown period the spent nuclear fuel will not be generated, the reactor will be shut down from the beginning of the shutdown period.

B.III.4.6. Non-Ionising radiation

B.III.4.6.1. Period of operation

PROJECT (UNITS 3+4)

Sources: overhead electric lines (power output, power supply), transformers, generators and other electric equipment

Electric and magnetic field in the vicinity of individual pieces of equipment will conform to the requirements of Government Decree no. 1/2008 Coll., on the protection of health from non-ionising radiation. On the power plant premises, the limits for staff will be observed, while in the publicly accessible outside areas (this only applies to power lines) the limits for other persons.

PLANT (UNITS 1+2+3+4)

Sources: overhead electric lines (power output, power supply), transformers, generators and other electric equipment

Electric and magnetic field in the vicinity of individual pieces of equipment will conform to the requirements of Government Decree no. 1/2008 Coll., on the protection of health from non-ionising radiation. On the power plant premises, the limits for staff will be observed, while in the publicly accessible outside areas (this only applies to power lines) the limits for other persons.

B.III.4.6.2. Preparation and implementation period

Sources: no significant sources

At the preparation and implementation period the significant sources of non-ionising radiation will not be used; electric and power-distributing equipment will meet the requirements of Government Decree no. 1/2008 Coll., on the protection of health from non-ionising radiation.

B.III.4.6.3. Shutdown period

Sources: no significant sources

At the shutdown period the significant sources of non-ionising radiation will not be used; electric and power-distributing equipment will meet the requirements of applicable regulations.

B.III.4.7. Noise

B.III.4.7.1. Period of operation

PROJECT (UNITS 3+4)

Technological sources: cooling towers, machine halls, compressor stations, cooling, emergency sources of power supply, transformers, switching station switches, steam generator safety valves, air-conditioning equipment, transport on the premises, possibly other

The new nuclear power plant is assessed in 2 power alternatives within the EIA process. These power alternatives were studied during the preparatory work for acoustic study and based on the assessment of individual model alternatives in terms of potential noise propagation to the outside area and neighbourhood, the “noisiest” alternative was chosen.

The Kočín switchyard operation is also related to the power plant, although it is a plant operated by another operator (ČEPS, a.s.). As a result of the project, the existing 400 kV as well as 110 kV part of the switchyard will be expanded, two present transformers will be replaced with two new transformers with a higher capacity of 350 MVA.

The Temelín Nuclear Power Plant operation also includes the non-standard sources, e.g. operation of steam-generator pressure relief valves, air by-pass stations and reduction station pressure relief valves.

This equipment is operated only sporadically, always for the shortest time required. The steam generator pressure relief valves do not open during normal operation. They open under the conditions of abnormal operation and during testing. The pressure relief valves are tested 1x year for 5 s only in the daytime. The pressure relief valve operation during the operating tests was verified directly using the measurement in the nearest neighbouring municipalities of Kočín and Temelín.

The air bypass station does not open during normal operation. It may open during the abnormal operation, upon emergency conditions and their testing. The air bypass stations are tested 1x year for several seconds only in the daytime.

The reduction station pressure relief valves are not used during normal operation. Their operation can be considered max. during tests or non-standard operating situation. Read Chapter C.II.3. Noise and other physical and biological characteristics (this document, page 257) for more detailed information.

Another operation that only takes place during the operating tests (possibly abnormal operation and under the emergency conditions) includes the operation of diesel-generator stations/combustion turbines.

The operation of the Temelín Nuclear Power Plant and the Kočín switchyard is continuous, identical during both the day and night.

Location: power plant, possibly Kočín switchyard premises

The sources of noise are located on the enclosed power plant, possibly switchyard premises in the outside areas, on the roofs and facades of buildings (machine hall, workshop, process buildings) and inside buildings.

Acoustic pressure:	cooling towers:	$L_{A,1m}$ = 75 dB
	power supply emergency sources:	$L_{A,1m}$ = 85 dB
	transformers:	$L_{A,1m}$ = 83 dB
	switching station switches:	$L_{A,1m}$ = 90 dB
	machine halls:	$L_{A,1m}$ = 85 dB
	compressor stations:	$L_{A,1m}$ = 85 dB
	HVAC:	$L_{A,1m}$ = 84 dB
	steam generator pressure relief valves:	$L_{A,1m}$ = 110 dB

The specified values are related to the distance of 1 m from the outlines of structures in the stabilised value for the time of machine operation.

Transport sources: off-premises traffic

During operation the source of noise will include the related transport on public roads and railway lines. The traffic caused by future demands is characterised in Chapter B.II.4. Demands on transport and other infrastructure (page 192 of this document).

PLANT (UNITS 1+2+3+4)

Technological sources: cooling towers, machine halls, compressor stations, cooling, emergency sources of power supply, transformers, switching station switches, steam generator safety valves, air-conditioning equipment, transport on the premises, possibly other

The future operation of Temelín Nuclear Power Plant is based mainly on the expansion of the existing operation. In other words, the existing plant premises will be expanded with new buildings associated with the operation of two new nuclear units. That means adding two reactor units with installing four new cooling towers and other service technologies related to the operation of new units. The whole expansion is planned in the area joining the existing premises towards the municipality of Temelín.

Location: power plant, possibly Kočín switchyard premises

The sources of noise are located on the enclosed power plant, possibly switchyard premises in the outside areas, on the roofs and facades of buildings (machine hall, workshop, process buildings) and inside buildings.

Acoustic pressure:	cooling towers:	$L_{A,1m}$ = 75 dB
	power supply emergency sources:	$L_{A,1m}$ = 85 dB
	transformers:	$L_{A,1m}$ = 83 dB
	switching station switches:	$L_{A,1m}$ = 90 dB
	machine halls:	$L_{A,1m}$ = 85 dB
	compressor stations:	$L_{A,1m}$ = 85 dB
	HVAC:	$L_{A,1m}$ = 84 dB
	steam generator pressure relief valves:	$L_{A,1m}$ = 110 dB

The specified values are related to the distance of 1 m from the outlines of structures in the stabilised value for the time of machine operation.

Transport sources: off-premises traffic

During the operation the source of noise will include the related transport on public roads and railway lines. The traffic caused by future demands is characterised in Chapter B.II.4. Demands on transport and other infrastructure (page 192 of this document).

B.III.4.7.2. Preparation and implementation period

Sources: building mechanisms, site transport

Noise, propagated from the construction site will depend on the type of works and organisation of work (time and spatial use of technology). In general, it will be the common building activity using common building and earth moving machines.

Location: premises of the site and site facilities

The sources will be operated at the construction site, possibly on the areas of site facilities.

Sound power:

compacting machines:	L_{WA} = 106 dB
dozers, loaders:	L_{WA} = 107 dB
lorries:	L_{WA} = 103 dB
mobile cranes:	L_{WA} = 105 dB
agitating lorries:	L_{WA} = 105 dB
power hammers:	L_{WA} = 105 dB
loaders:	L_{WA} = 107 dB

Sound power of the used machinery is limited by Government Decree no. 9/2002 Coll., that lays down technical requirements for products in relation to noise emission, as amended by Government Decrees no. 342/2003 Coll. and 198/2006 Coll.

Transport sources: off-site transport

During the preparation and construction, the off-site transport on public roads and railway lines will be the source of noise. The traffic caused by building activity is characterised in Chapter B.II.4. Demands on transport and other infrastructure (page 192 of this document).

B.III.4.7.3. Shutdown period

Sources: operational technology (necessary),
disassembling and demolition technology

During the shutdown period, the necessary sources for maintaining the operation being terminated will be operated as well as the disassembling, possibly demolition technology.

Location: power plant premises

The sources of noise will be located on the enclosed power plant premises.

Sound power: will not exceed the period of operation, possibly construction

The sound power of the sources will not exceed the period of operation, possibly construction.

Transport sources: off-site transport

During the shutdown period the source of noise will include the off-premises transport on public roads and railway lines. In general, the traffic will be low and will not exceed the period of operation, possibly construction

B.III.4.8. Vibrations

B.III.4.8.1. Period of operation

PROJECT (UNITS 3+4)

Technological sources: machine halls

The operating vibrations are limited to the spaces of inside structures, mainly the machine halls. The transfer of vibrations from turbines to the subbase of turbine housing is minimised by proper turbine mounting. The project is not the source of vibrations propagating to the neighbourhood.

Transport sources: off-premises traffic

The dynamic effects of the motion of vehicles driving along public roads are a potential source of vibrations. They are common traffic sources that are muffled in the subbase already in the close vicinity of roads.

PLANT (UNITS 1+2+3+4)

Technological sources: machine halls

The operating vibrations are limited to the spaces of inside structures, mainly the machine halls. The transfer of vibrations from turbines to the subbase of turbine housing is minimised by proper turbine mounting. The project is not the source of vibrations propagating to the neighbourhood.

Transport sources: off-premises traffic

The dynamic effects of the motion of vehicles driving along public roads are a potential source of vibrations. They are common traffic sources that are muffled in the subbase already in the close vicinity of roads.

B.III.4.8.2. Preparation and implementation period

Technological sources: building mechanisms

In terms of building vibrations, only common building machinery is considered (vibrating rollers, concrete vibrators etc.); their impact will be limited to the close vicinity of performed works.

The use of blasting operations using explosives during the construction is not anticipated.

Transport sources: off-premises traffic

The dynamic effects of the motion of vehicles driving along public roads are a potential source of vibrations. They are common traffic sources that are muffled in the subbase already in the close vicinity of roads.

B.III.4.8.3. Shutdown period

Technological sources: operational technology (necessary),
disassembling and demolition technology

Only the sources mentioned above for the period of operation, possibly construction, are considered, without a significant effect on the neighbourhood.

Transport sources: off-premises traffic

Only common transport sources are considered, without a significant effect on the neighbourhood.

B.III.5. Additional data

B.III.5.1. Period of operation

PROJECT (UNITS 3+4)

Other demands: insignificant

No requirements for any demands other than those described above arise.

PLANT (UNITS 1+2+3+4)

Other demands: insignificant

No requirements for any demands other than those described above arise.

B.III.5.2. Preparation and implementation period

Other demands: common

No requirements for any demands other than those described above arise. The necessary ground shaping of the area was already made during the construction of the first two units. After the end of building activities, the reclamation of the construction site surfaces using the hidden and temporarily deposed soil is assumed.

B.III.5.3. Shutdown period

Other demands: common

No requirements for any demands other than those described above arise. It is assumed that excess masses will be recycled and used for other purposes, only the excesses will be disposed of in respective landfills.

PART C
INFORMATION ON THE STATE OF THE ENVIRONMENT IN THE AFFECTED AREA

C.1. LIST OF MAJOR ENVIRONMENTAL CHARACTERISTICS OF THE AFFECTED AREA

The Temelín Nuclear Power Plant is located in the affected area.

The affected area is not located in the area with a special mode of nature conservation and landscape protection. Technically, this means:

- There is no specially protected area in the affected area, nor is this affected area a part of a specially protected area. The affected area is not located in a national park or a protected landscape area, there are no national nature reserves, nature reserves, national nature monuments or nature monuments declared in the affected area.
- The affected area (the area of intended construction) does not include any features of the territorial system of ecological stability; the features of the territorial system of ecological stability as well as significant landscape features are present in the neighbourhood.
- The affected area is not a part of a natural park.
- The affected area is not a part of the Natura 2000 network.

The area of construction comes under the jurisdiction of the Building Authority in Týn nad Vltavou. According to Notice no. 8 (defining areas with poor air quality - APAQ) published in Journal of the Ministry of the Environment, volume 6 of June 2009, on 1.5 percent of the area under the authority of this office the target pollution limit is exceeded for benzo(a)pyrene.

The project is located outside the flood plain Q_{100}. The affected area does not include a water resource protective zone in accordance with Act no. 254/2001 Coll., the Water Act, as amended. The affected area is not located in a protected area of natural water accumulation (CHOPAV).

In the affected area, there were no conflicts of interests with the active mineral deposits, protected deposit areas and mining areas, registered within the deposit protection maps.

The project is not in the area conflict with tangible property.

No extreme circumstances that might affect the project feasibility were found in the affected area.

For the detailed data see the respective chapters of part C.2. Characterisation of the current state of the environment in the affected area (page 223 and the following in this documentation).

C.2. CHARACTERISATION OF THE CURRENT STATE OF THE ENVIRONMENT IN THE AFFECTED AREA

C.2.1. Population and public health

C.2.1.1. Demographic characteristics

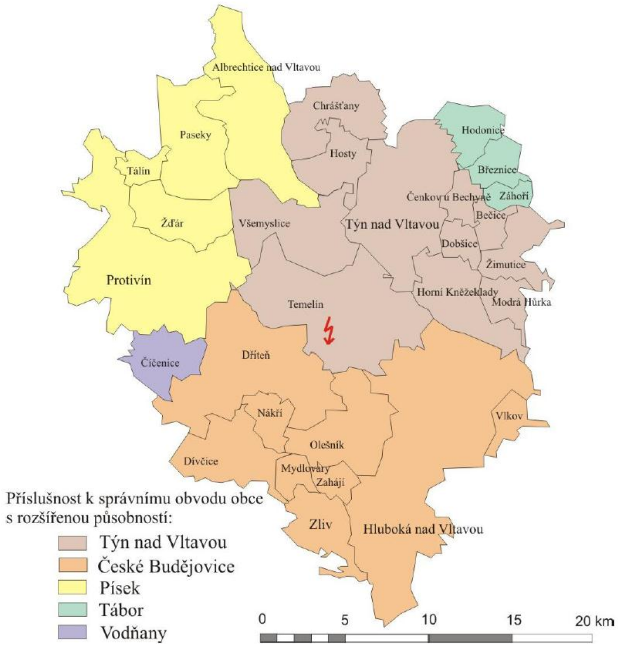
C.2.1.1.1. Determination and location of the area of interest

Primarily, the area of interest is delimited at approximately a 13 km distance from the Temelín Nuclear Power Plant, which tallies with the emergency planning zone as specified since 1997 and at the same time matches the so called exposed areas defined within the long-term monitoring of public health in the neighbourhood of the plant.

The area is located in the central part of the South-Bohemian Region, the nearest important town is the regional centre of České Budějovice; Týn nad Vltavou is the natural centre of lower significance. The region is located at the southern tip of the Táborská pahorkatina (the Tábor Uplands); it reaches to Českobudějovická pánev (České Budějovice Basin) with its southwestern edge. It is situated along part of the foothill course of the Vltava (the Elbe catchment) and in its confluence with the right-hand tributary, the Lužnice. The area of interest has agricultural character with small industrial enterprises (except the Temelín Nuclear Power Plant).

The area of interest includes a total of 29 municipalities, of which 4 are towns. They include specifically the towns of Týn nad Vltavou, Protivín, Hluboká nad Vltavou, Zliv and the villages of Albrechtice nad Vltavou, Bečice, Březnice, Čenkov u Bechyně, Číčenice, Dívčice, Dobšice, Dříteň, Hodonice, Hosty, Horní Kněžeklady, Chrášťany, Modrá Hůrka, Mydlovary, Nákří, Olešník, Paseky, Tálín, Temelín, Vlkov, Všemyslice, Zahájí, Záhoří, Žimutice, Žďár. In terms of the administration, 19 municipalities stretch to the district of České Budějovice, 5 to the district of Písek, 4 to the district of Tábor and one municipality to the district of Strakonice.

Figure C.2.1: Administrative competence of the municipalities in the Temelín area to the municipalities with extended competence

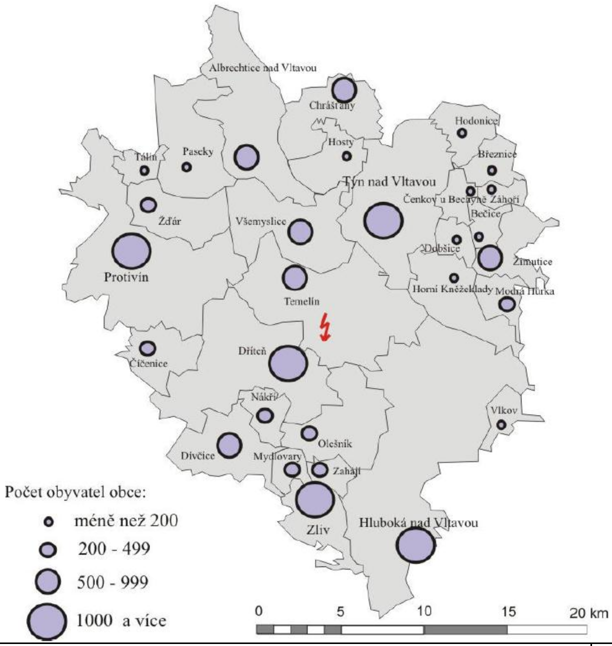


Příslušnost k správnímu obvodu obce s rozšířenou působností	Areas by administrative centre precinct

C.2.1.1.2. Population

As at 31 December 2008, the Temelín area of interest had a total of 31,987 inhabitants, of which 49.6% were male. 70% of the population is concentrated in the four towns, the largest town being Týn nad Vltavou with 8,528 inhabitants. The smallest municipality is Vlkov with 19 inhabitants which is at the same time the smallest (in terms of population) actually functioning municipality in the Czech Republic. The density of population is 53 inhabitants/km^2, in the built-up area there are 44 inhabitants/ha.

Figure C.2.2: Size structure of the municipalities in the Temelín area as at 31 December 2008



Počet obyvatel obce	Town/village population
méně než 200	less than 200
1000 a více	1,000 and more

The situation in the population of the Temelín area was stabilised from the first census in our territory in 1869 until World War II and it oscillated between 27,000-30,000 inhabitants (see the following figure). The drop in population below the level of 25,000 during the post-war period was rather significant, followed by a sharper increase from 1969 - the area reached the level of 30,000 inhabitants again in 1991 (the population matched the situation in 1910). The increase in population since the 1980s has been affected by the Temelín Nuclear Power Plant, since its construction and operation resulted in immigration flows. Mainly Týn nad Vltavou (background of the power plant personnel) was the gainful town (in terms of population), with the increase in population between 1970-1980 forming the full 63% of the total increase of the Temelín area population, or 72% in the following decade as the case may be.

Figure C.2.3: Trend in the population of the Temelín area, 1869-2008

Počet obyvatel	Population

In accordance with the balances of population in 2007 and 2008, the slight increase in population is characteristic of the current Temelín area territory. In the above-mentioned two years the area gained 93 inhabitants as a result of mechanical movement of population (migration), the natural gain was 28 people. The strongest migration flows headed towards the municipalities of Zahájí, Týn nad Vltavou, Dříteň, Olešník and Žimutice; on the other hand the largest loss-making municipalities included those of Zliv, Protivín and Hluboká nad Vltavou. The natural increase in most municipalities oscillated around zero, the most positive one was in Týn nad Vltavou (22 people) and Zliv (19 people). The total slight increase in population in the Temelín area in the above-mentioned two years equalled to 121 people; that is 3.8‰.

C.2.1.2. Public health

C.2.1.2.1.Monitored areas and characteristics

This chapter of the documentation is used to summarise and evaluate the selected indicators of public health in the area of interest and compare them with the national data and the data from more distant areas. It is based on the results of long-term monitoring in the neighbourhood of the Temelín Nuclear Power Plant, performed by the Department of Preventive Medicine of the Faculty of Medicine of Masaryk University in Brno since the beginning of the 1990s (Kotulán et al., 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008). For those interested, the results are available in the power plant information centre. The health monitoring is going to continue.

The summary of results is provided in Annexe 3 to this documentation which is referred to in the details and which also shows the tabular data.

The selection of applied health indicators is based on the potential effects of the power plant, given by ionising radiation (radioactive nuclides released to the environment) as well as the psychological effects (feelings of anxiety and psychic tension from the vicinity of the power plant and fears of potential unfavourable effects and risks). The indicators that might be potentially affected by the specified effects of the power plant are significant. In addition to the mortality rate, being the basic health indicator, they include the incidence of malignant neoplasms (with special focus on the malignant growth of lymphatic and hematopoietic tissue), as well as the incidence of disorders of the population reproductive process (procreation).

In order to detect the potential power plant impacts, the two so called exposed areas (closer and more distant) around the power plant are defined in territorial terms and the findings from those areas are compared with the analogical findings from two control areas with ideally similar social, economic and cultural background. The list and characteristics of the areas are as follows (the specified population is adopted from the data of the Czech Statistical Office (CZSO) and rounded to hundreds):

The closer exposed area (E1) is within the sphere of direct and close visibility of NPP Temelín from the territory of included municipalities. Their population lives with the permanent awareness of the close proximity of the power plant. The area includes 5 administrative municipalities (Dříteň, Nákří, Temelín, Týn nad Vltavou, Všemyslice) with the total of 25 annexes including villages and settlements. In 2008, 12,000 inhabitants lived there.

The more distant exposed area (E2) is the annular area following the perimeter of the closer exposed area (E1) and reaching as far as the borderline of the specified emergency protection zone, i.e. the distance of approximately 13 km from NPP Temelín. It includes 24 administrative municipalities with the total of 48 annexes including the villages and settlements. In 2008, 19,900 inhabitants lived in the area.

For the purpose of certain assessments, the closer and more distant areas (E1 + E2) are connected to the *total exposed area (EC)*, with 31,900 inhabitants.

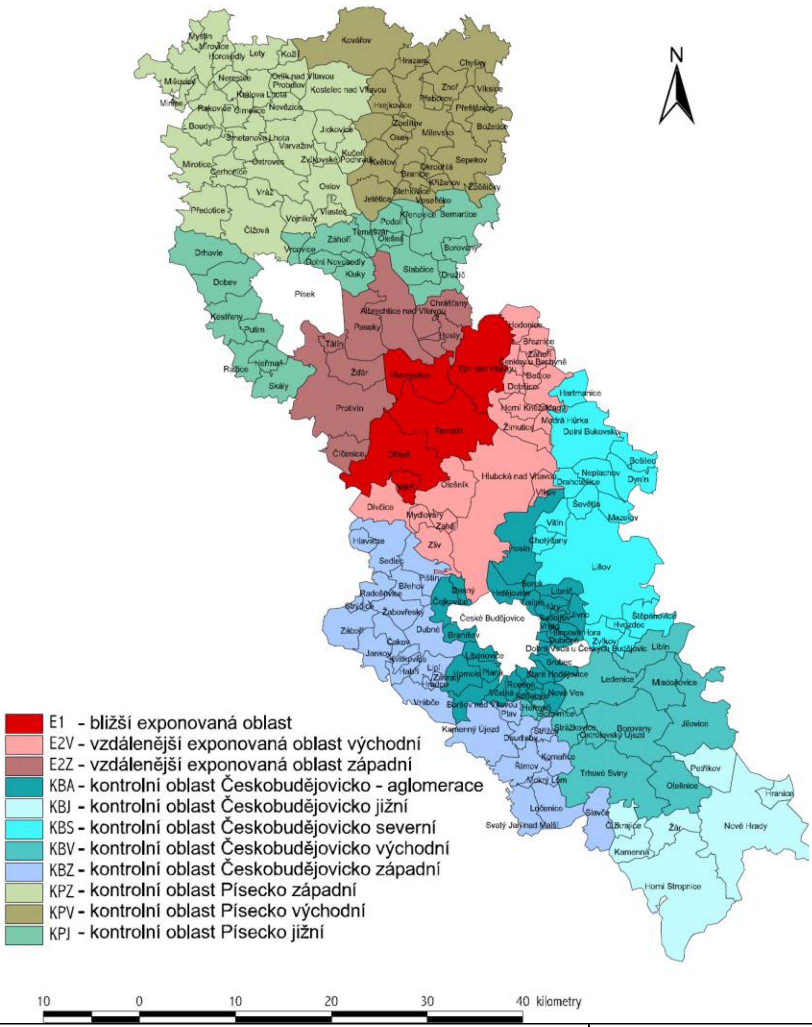
The *České Budějovice control area (KB)* is the set of remaining municipalities in the České Budějovice district (not included in the exposed areas) excluding the town of České Budějovice and its annexes. It includes 88 administrative municipalities with the total of 148 annexes including villages and settlements. In 2008, 64,400 inhabitants lived there.

The *Písek control area (KP)* includes the remaining municipalities in the Písek district (not included in the exposed areas) excluding the town of Písek and its annexes. This area includes 70 administrative municipalities with the total of 170 annexes including villages and settlements. In 2008, 34,200 inhabitants lived there.

For evaluation purposes the most exposed and control areas are further divided to smaller districts.

The total of 130,500 inhabitants live in the monitored exposed and control areas. Definition of the areas is obvious from the following figure.

Figure C.2.4: Classification of municipalities to the monitored areas



E1 – bližší exponovaná oblast	E1 - nearby exposed area
E2V – vzdálenější exponovaná oblast východní	E2V - more remote exposed area east
E2Z – vzdálenější exponovaná oblast západní	E2Z - more remote exposed area west

KBA – kontrolní Českobudějovicko – aglomerace	KBA - České Budějovice control area – agglomeration
KBJ – kontrolní Českobudějovicko jižní	KBJ - České Budějovice control area south
KBS – kontrolní Českobudějovicko severní	KBS - České Budějovice control area north
KBV – kontrolní Českobudějovicko východní	KBV - České Budějovice control area east
KBZ – kontrolní Českobudějovicko západní	KBZ - České Budějovice control area west
KPZ – kontrolní Písecko západní	KPZ - Písek control area west
KPV – kontrolní Písecko východní	KPV - Písek control area east
KPJ – kontrolní Písecko jižní	KPJ - Písek control area south
kilometry	kilometres

The data on the results of monitoring are specified separately for the first period of power plant construction and completion, i.e. the pre-operational period (1992-2001) and separately for the second period after the start of operation, i.e. the operational period (2001-2007).

C.2.1.2.2. Mortality rate

As the basic health indicator, the mortality rate was evaluated annually, even retrospectively, from 1992 to the last year with the available data (2007). In addition to the total mortality rate (all causes of death), the cardiovascular mortality rate and malignant neoplasm mortality rate were evaluated. Those are the two most frequent cases of death, the first one related in a certain way to stress while, theoretically, the latter might be affected by ionising radiation.

In addition to the aggregate data for all age groups, the mortality rate in the productive age (20-64) was specifically evaluated, since it reflects the impacts of living conditions in certain ways more sensitively than the mortality rate which also includes higher age strata. It deals with the evaluation of the deaths that can be considered downright “premature” from a biological point of view. However, the formal disadvantage includes the lower number of cases and thus lower possibility to prove the statistical conclusiveness of the established differences.

In addition, the internationally recommended indicator YPLL - Years of Potential Life Lost was evaluated for the ages of 1-64. It is the age-standardised average number of years that remained to the deceased in the respective age range to achieve 65. It expresses the rate of death prematurity and therefore the impact of living conditions even more specifically. The results for individual areas were assessed among each other and in relation to the national data.

Since the mortality rate is one of the health indicators with the frequency changing depending on the age, the reflection of living conditions in different groups of the population cannot be compared using simple indices (e.g. crude death rate, i.e. the total number of deaths per 100,000 living people), because for a population with a higher share of elderly people the index is higher without showing the quality of health in the respective group of the population. For the comparison, the age standardisation, i.e. the mathematical recalculation that is used to adjust the results in order to eliminate the effect of different age structures, is therefore always required. Therefore, the mortality rate indicators are age-standardised in all cases. All characteristics are calculated separately for males and females.

C.2.1.2.2.1. Total mortality rate (all age groups)

The total mortality rate for *males* in the exposed areas is close to the national level and more frequently below it, in one case significantly. The same applies to the cardiovascular mortality rate, where in area E2 the mortality rate was significantly higher in the pre-operational period, while in the operational period it also dropped below the national figures. The carcinoma death rate was extremely low in area E1 in the pre-operational period; in the operational period it is right below the average in the Czech Republic and it does not differ significantly from it. The control areas also range near the level of the Czech Republic, however, they differ from it significantly in both directions more often. The tests of statistical significance of differences between the areas did not show any signs of potential unfavourable impacts of the power plant.

For *females* the situation is similar to that of males. In the exposed areas, the indicators are close to the national level for all monitored types of mortality rate and they either do not significantly differ from it or are significantly lower. On the other hand, the control areas rather show the figures above the national level.

The differences between the exposed and control areas are partly significant, in both periods always showing the more favourable indicators in the neighbourhood of NPP Temelín. That means that there are no signs of potential unfavourable NPP Temelín impacts.

C.2.1.2.2.2. Mortality rate in the productive age

The total mortality rate (all age groups), dealt with in the previous chapter, is one of the basic health indicators, however, it is not apt enough for the assessment of the impact of living conditions. Elderly people form the majority among the deceased (e.g. 64% of males die at an age over 65 and 33% over 75), which largely conceals the “premature” deaths of younger people that are more closely related to such unfavourable living conditions. With increasing age, elderly people are still an increasingly selective population group of individuals with above-average inherent resistance, since their less disposed contemporaries have already died out gradually before. On the other hand, the internal biological degradation processes related to age apply unfavourably with them. The relations of their mortality rate to the living conditions have therefore a different nature than in the younger age strata. For those reasons the mortality rate in the productive age (20 to 64 years) is used as the second indicator, which should reflect the potential unfavourable effects of living conditions more sensitively than the total mortality rate. Of course, the numbers of the dead are smaller there and may reduce the probability of finding the statistic conclusiveness of significance of found differences.

For *males* the productive age mortality rate in the exposed areas mostly does not differ significantly from the national aggregate. Only in the pre-operational period, the cardiovascular mortality rate in area E2 was significantly higher and the malignant neoplasm mortality rate in area E1 was significantly lower. In the operational period the above-specified differences were balanced out. In comparison with the control areas, the total mortality rate and the cardiovascular mortality rate in area E2 were significantly higher, while, on the other hand, the malignant neoplasm mortality rate in E1 was significantly lower. In the operational period there was a change in the total mortality rate, which is significantly higher in E1 than in the KB control area, where it is particularly low. In the cardiovascular mortality rate, and that of malignant neoplasms, the mutual differences are insignificant.

For *females,* the total mortality rate in exposed areas is lower than the national level in both periods, which was statistically significant in area E2; for cardiovascular and malignant neoplasm mortality rates it does not differ significantly from the figures for the Czech Republic. The results are rather variable here due to a low number of cases. The correlations between the exposed and control areas are mainly insignificant; it is only significant for the cardiovascular mortality rate, higher in area E1 compared to the KP control.

In general, the results are rather irregular due to the small number and they do not show an obvious general trend of the potential unfavourable NPP impact.

C.2.1.2.2.3. Years of potential life lost

It has been mentioned in the previous chapter that for the assessment of the impact of living conditions, the mortality rate in the younger age is especially important, since it characterises “premature” deaths from the biological point of view. The rate of the prematurity is stressed in the internationally used indicator of “Years of Potential Life Lost” (usually abbreviated as YPLL), where the unachieved years are summed for the examined population group, i.e. the years that the individual prematurely dead lacked in order to achieve the specified age limit, usually 65 years. With respect to the special status of infant mortality rate, infants to the age of 1 are usually excluded and only deaths between the ages of 2 to 64 are taken into consideration. The sum of remaining years is age-standardised and recalculated to the common denominator, usually 1,000 inhabitants of the same age category (1-64 years old) and possibly also the sex, if the calculation is performed for males and females separately.

Thus the defined and age-standardised YPLL indicator (recalculated to 1,000 inhabitants) is calculated for both males and females and for both evaluated periods (pre-operational as well as operational). The results show that the findings in the examined areas are mostly below the national level. Only a higher YPLL in the operational period in area E1 is the exception. The tests' significant differences showed that compared to the České Budějovice control area, area E2 has a higher YPPL for *males* in the pre-operational period, while it is area E1 in the operational period. On the other hand, in the case of *females,* area E2 has a significantly lower level compared to KP in the pre-operational period, while in the operational period the differences are insignificant.

C.2.1.2.2.4. Discussion on the results

The mortality rate in the population is one of the basic health indicators; it is often used as the basis for a deeper analysis of the population health. Its advantages include the unambiguousness of recorded phenomena (deaths) and a perfect detection rate. Therefore it provides a good comparison among population groups. That is why a detailed assessment of various mortality rate indicators is an indispensable part of the evaluation despite the fact that a potential impact of the existence and operation of NPP Temelín on the mortality rate is quite improbable and nor has it been discovered in the neighbourhood of nuclear facilities anywhere in the world.

Mortality rate is the indicator of the impact of living conditions, especially in relation to the illnesses that have a relatively short duration and high case-fatality ratio. It shows significantly less incidence of long-term diseases, successfully curable diseases and lighter diseases that do not affect life, or they are not detected at all, as the case may be. It is therefore only a partial measure for the health situation. That must be considered in the interpretation of results.

The evaluation is naturally focused on the exposed areas, specifically mainly on the vicinity of the power plant (E1), where the potential unfavourable impacts (psychological or other) would most probably act.

The following might be considered a criterion for a potential unfavourable impact of NPP Temelín:

a) higher mortality rate for the closer exposed area E1 than for area E2,
b) higher mortality rate for the exposed areas than for the control areas,
c) rise of the above-mentioned unfavourable symptoms only after the start of the NPP Temelín operation,
d) parallel affection of both males and females.

None of the criteria has been unambiguously proved. If significant differences between the exposed areas E1 and E2 appeared, they more frequently had an opposite direction, i.e. lower mortality rate in the vicinity of NPP Temelín than in the more distant neighbourhood. The significant differences in both directions were also noticed in the relation between the exposed and control areas. An unfavourable effect in the second (operational) period only occurred sporadically, specifically for the total mortality rate (all diagnoses) in the productive age. It is obviously one of the signs of result variation which is generally substantial. Other sporadic incidences of less favourable effects from the pre-operational period (higher E1, higher exposed areas over the control ones) were not proved in the second period. None of the signs of unfavourable effects was observed parallelly for both sexes.

For the above-specified reasons, and also since in the mortality rate evaluation in districts, the exposed districts were always approximately in the middle of the total variance, we can conclude that the vicinity of NPP Temelín has no effect on the mortality rate characteristics in its neighbourhood.

It was further determined whether the mortality rate in the monitored areas and districts roughly corresponds to the national level. This question can be answered positively. All mortality rate indicators in all areas and districts range around the national level which is used as a suitable comparative criterion. The established variations are however rather high. The zero hypothesis was that the characteristics of mortality rate in the areas and districts will not only be close to the national average, but that they will also be rather similar, since they apply to the population groups living in the sociocultural conditions that do not appear as markedly different from each other or from the general situation in the Czech Republic. However, this assumption was not partly proven. As for the mortality rate indicators, many monitored areas and districts deviate statistically significantly both from the national figures and from the figures of the areas and districts closer, and often neighbouring. The cursory interpretation of such findings might easily result in erroneous conclusions of the unfavourable or, on the contrary, favourable effect of NPP Temelín or other significant enterprises in the respective area. The causes are nevertheless deeper and they are given by a complex of the local, social, economic, demographic, health and other living conditions.

C.2.1.2.3. Incidence of malignant neoplasms

Higher doses of ionising radiation may contribute to the rise of some tumours. The awareness of its effect also exists among the lay public and the people living in the neighbourhood of nuclear facilities fear the potential risk of increased incidence of cancer. Therefore the evaluation of the incidence of malignant tumours in examined areas is desirable, although based on the existing knowledge the increased incidence of tumours as a result of NPP Temelín cannot be expected. The level of emitted radiation is minute and there are no conclusive cases known from the literature.

Unlike the above-described mortality rate, the incidence (occurrence of newly diagnosed cases) is the indicator of morbidity for that group of diseases. In the analysis of potential effects of living conditions on the incidence of malignant tumours, rather little knowledge would be obtained if we only dealt with the total sums of all cases. There are about 50 basic types of malignant growth (depending on the affected organ, tissue, histological structure etc.). They differ from each other by causal effects (determinants) and they have different risk factors. That is why it is also desirable to examine the incidence of individual types of tumours separately. As a result of that, however, the numbers of found cases for the limited population groups drop, often below the statistically acceptable limit. Therefore, in the case of the exposed and control areas, for the evaluation of impacts of NPP Temelín the selection for monitoring included the relatively frequently occurring tumours, as well as the tumours with at least partially acceptable incidence which are known from the literature as being affected by the ionising radiation in their rise if it is applied in sufficiently high doses.

For the above-specified reasons the incidence of the total number of tumours (except for the so called “other skin tumours” according to international classification, as their detection is unreliable and insignificant in relation to the assumed radiation levels) as well as the selected types of tumours (with more frequent incidence and potential relation to the ionising radiation) is monitored in the exposed and control areas, especially the malignant neoplasms of the stomach, large intestine, rectum, pancreas, lungs, breast, prostate, bladder, kidneys and a group of malignant neoplasms of the lymphatic and hematopoietic tissue. In all cases, like in the mortality rate case, the age standardisation was performed in order to provide comparability of the findings.

C.2.1.2.3.1. All malignant neoplasms together (except “other skin”)

For *males,* the incidence in the pre-operational period is significantly below the national level in the closer exposed area E1. It is also similar for the KB control area, in both monitored periods. Regarding the comparison with the control areas, the incidence for E1 in the pre-operational period was significantly lower than for E2 and the KP control area. On the contrary, in the operational period, the incidence in area E1, compared to low levels of incidence in the KB and KP control areas, is significantly higher.

For *females,* both control areas are significantly below the level of the Czech Republic in both periods. In the pre-operational period, they are significantly below the total exposed area EC, while in the operational period; KB is even significantly lower than E1.

That means that for both sexes the incidence in the close exposed area increased significantly. That finding, however, cannot be related to the effect of NPP Temelín, since the period of operation is still short and the carcinogenic process is known to be a long-term one; the tumours usually appear 10-15 years after the first contact with the carcinogenic agent, or even later. The fact that the causes of differences are different is also proved by the high diversity of results in individual control districts, ranging from very low figures for some to relatively high figures for others. No relation to the distance from NPP Temelín is obvious. Moreover, in the second period the increased indices exist only in one half of the more distant exposed area (E2V), while in the other half (E2Z) they are low.

C.2.1.2.3.2. Malignant neoplasms of the stomach

In this case, the tumours are relatively rare, and moreover their number has been decreasing in our, as well as in other advanced countries over last decades. Low numbers of cases result in accidental deviations without any general validity. That is why no value significantly different from the level of the Czech Republic has been found. The total exposed area EC has lower incidence than the KB control for males, otherwise there are no significant differences present between the areas for males or females. There is no sign of the effect of NPP Temelín.

C.2.1.2.3.3. Malignant neoplasms of the large intestine

In the evaluation of this group of tumours, first the tumours of the large intestine and those of the rectum are processed separately and after that, with respect to their similar aetiology and common risk factors, they are also joined into one group (see C.2.1.2.3.5.).

The incidence of large intestine tumours shows that the exposed areas do not significantly differ from the national level; the incidence in the control areas is significantly lower in some cases. For *males,* the incidence of large intestine tumours in the pre-operational period in the closer exposed area E1 was very low, significantly lower than in the more distant E2 and KP control area. In the operational period the significance of these differences disappears. For *females,* the incidence in the first period in area E1 was relatively high, significantly above the KP control area. On the other hand, there are very low incidences in the KBJ and KPJ areas, significantly below the level of the Czech Republic as well as that of the exposed districts. In the operational period, the exposed district E2V has significantly lower incidence than the KPZ and KPV controls.

C.2.1.2.3.4. Malignant neoplasms of the rectum

The incidence of rectal tumours does not significantly differ from the average in the Czech Republic with one exception. The number of cases is again small so the results are greatly irregular. In correlations between the exposed and control areas there are no significant differences in the pre-operational period. In the operational period in the case of *males* there is a cross relation; the exposed area E1 has significantly higher incidence than the KB and KP controls, on the contrary, significantly higher than the exposed E2. For *females,* the exposed area EC is significantly lower than the KP control. Those are again fluctuating variations of results that have nothing in common with the potential effect of NPP Temelín.

C.2.1.2.3.5. Malignant neoplasms of the large intestine and rectum

Joining the above-specified intestinal tumours into a single common group further proved the above-specified irregularities. In the pre-operational period there were no significant differences between the areas mutually and, in relation to the level in the Czech Republic, there was only one isolated significant difference (in the KP area for females). In the operational period, one of the control areas is significantly above the national level, the other one is significantly below it. The incidence in area E1 in the case of *males* is numerically rather high, however, it does not differ significantly from the control areas. The incidence in the KP control area is even higher, significantly above the exposed E2 and EC. Also for *females,* the incidence in areas E2 and EC is significantly lower than in the KP area. In general, these are different and partly conflicting relations, which obviously are not connected to NPP Temelín.

C.2.1.2.3.6. Malignant neoplasms of the pancreas

Tumours of the pancreas are even rarer than the above-described stomach tumours. No special significance can therefore be credited to their very low incidence for males, or very high for females as the case may be, in the NPP Temelín neighbourhood in the pre-operational period. In the operational period there are no significant relations for the areas.

C.2.1.2.3.7. Malignant neoplasms of the lungs

Neither do the tumours of the lungs prove any negative NPP Temelín effect. In the pre-operational period the incidence for *males* in the closer exposed area is significantly lower than in E2 and KP control; in the operational period the differences between them are insignificant. The results therefore directly contradict the notion of the potential unfavourable effect of NPP Temelín, since the relations have the opposite direction. On the other hand, in the case of *females* the incidence in exposed areas is significantly higher than in the extremely low KBA and KPV. And again, too small a number of cases have an unfavourable effect here.

C.2.1.2.3.8. Malignant neoplasms of the female breast

The incidence of female breast tumours does not differ significantly from the national level in the exposed area in both monitored periods; the incidence in the control areas is lower. The differences between the exposed and control areas are statistically insignificant. There are some significant differences between the exposed and control districts, in both directions. In terms of the spatial relation to NPP Temelín the results do not indicate any traceable trend.

C.2.1.2.3.9. Malignant neoplasms of the prostate

The incidence of prostate cancer shows a very low level in the close exposed area (E1) in both monitored periods, which is significantly lower when compared to the Czech Republic, and in the first period also compared to the more distant E2 and KP control. In general, an opposite image is indicated than might be expected in the case of an unfavourable NPP Temelín impact.

C.2.1.2.3.10. Malignant neoplasms of the urinary bladder

As like with the intestinal tumours, individual tumours (in this case of the bladder and kidneys) are processed separately and then, with respect to their similar aetiology, all tumours of the urinary system together (see C.2.1.2.3.12.).

As for bladder tumours in the case of *males,* there was a very low incidence in the control areas in the pre-operational period, mainly in KB, in the latter in KP. In the exposed area E1 the incidence was relatively high in numerical terms in the operational period. However, it did not exceed the national level or that of the control areas significantly. For *females,* on the other hand, the incidence was extremely low in the closer exposed area in both periods, in the second period it was even zero (significantly below both KB and KP). No relation to NPP Temelín can be derived in this case.

C.2.1.2.3.11. Malignant neoplasms of the kidneys

Malignant kidney tumours show a different image. For *males* the incidence was relatively high in exposed areas in the pre-operational period, it exceeded the level of the KB control area significantly and as a whole (EC) the level of the Czech Republic. However, the situation improved substantially in the operational period, so no significant differences can be traced. For *females* no significant difference was found except for the high levels in the KP control area (in the first period).

C.2.1.2.3.12. Malignant neoplasms of the urinary system

The joint evaluation of all urinary tumours shows a similar situation as for the kidney tumours. The increased incidence figures for *males* in exposed areas E2 and EC in the pre-operational period (significantly above the control areas) dropped in the operational period to levels without any significant differences. For *females* there were no significant differences found in the pre-operational or operational period.

C.2.1.2.3.13. Malignant neoplasms of lymphatic and Hhmatopoietic tissue

The last group for which incidence was evaluated in the compared areas, includes the neoplasms of lymphatic, hematopoietic and related tissue. This group includes 16 types of malignant neoplasms, all types of leukaemia, lymphomas, myelomas etc. For some of them the relation to ionising radiation was proved in both epidemiological and radiological studies. Individually the above-specified types of malignant growth occur very rarely and is why they are evaluated jointly. Yet even so, this group still includes a relatively small number of cases, which complicates the possibility to prove the statistically significant differences. No significant differences from the level in the Czech Republic were found; mutual testing of the exposed and control areas did not bring any significant results either.

C.2.1.2.3.14. Incidence of childhood leukaemia

In professional literature as well as among the public, considerable interest was awoken by the news of an increased number (accumulation, “clusters”) of leukaemia and other malignant neoplasms of the lymphatic system (the so called non-Hodgkin lymphomas) among children, mainly 0-4 years old, and in some rare cases also among youth under the age of 25, in the neighbourhood of nuclear facilities in recent decades. In 1983, this occurred in England in the vicinity of the nuclear conglomerate in Sellafield and later also in the vicinity of other nuclear facilities. Among them, attention has recently been drawn mainly to the neighbourhood of the nuclear power plant in Krümmel, the Federal Republic of Germany. However, for the vast majority of nuclear power plants, no such effects were found despite the frequent and detailed investigations in various countries. The summary of extended scientific literature on these issues has recently been provided, mainly by B. Grosche (2006) and D. Lauriel et al. (2008). Despite the extensive effort and very detailed investigation, the causal relation to the close nuclear facilities was not proved in the above-specified cases of increased incidence. Still these issues are handled with increased attention. That is why the incidence of above-mentioned diseases among children and the youth has been processed in details.

In view of the fact that the incidence of these diseases is very rare, each individual case is specified. It is obvious that in 15 years of monitoring, only 9 cases were registered in the monitored area, 3 cases in the exposed districts and 6 in the control ones; in the exposed areas the mentioned cases only applied to 1 leukaemia, most often described in the literature in the neighbourhood of nuclear plants; while non-Hodgkin lymphomas were only found abroad in some cases, there was no case present in the exposed districts for the age of 0-4 (which according to the literature is the most typical age for the respective diseases in the neighbourhood of nuclear facilities), but only for the adolescence and young adults, mentioned in the literature in this connection only rarely.

For the information and comparison, in this case the comparison is made with the incidence of leukaemia and non-Hodgkin lymphomas among children and youth in the Czech Republic in 2006 (according to the publication of the Institute of Health Information and Statistics of the Czech Republic Novotvary (Neoplasms) 2006). With its use, the rough estimation of “expected” case numbers in the monitored area, i.e. the occurrence that might be expected provided the incidence matched the national average, can be made. In the population under the age of 24, the above-specified diseases occur in 3.06 per 100,000 people of the respective age per year. The area neighbouring NPP Temelín has been monitored for 15 years, which would correspond to 3.06 x 15, i.e. 45.9 cases per 100,000 people under 24 years of age. According to the IHIS CR data from 2006, people under 24 form 27.65% of the population. If there was the same age structure in the monitored area, approximately 36,000 people under the age of 24 would live there (from the total of 130,500 inhabitants). That would match an expected number of 16.5 cases. Only 9 cases were found, which is much less. Using the same procedure for the exposed area, we will come to the expected number of 4.0 cases, while 3 cases were found. The performed estimate, however, is very rough, but it at least still proves with sufficient reliability that the incidence in the monitored areas as a whole, or in the exposed area, is not above the national level.

Based on the above-specified facts we can state with certainty that the clustering of childhood leukaemia (and possibly other neoplasms of lymphatic system), described in the neighbourhood of some nuclear facilities, is not present in the neighbourhood of NPP Temelín.

C.2.1.2.3.15. Discussion on the results

Like in the mortality rate evaluation, the potential unfavourable effects of NPP Temelín might especially be proven in

a) higher incidence for the closer exposed area E1 than for the area E2,
b) higher incidence for the exposed areas than for the control areas,
c) rise of the above-mentioned unfavourable symptoms only after the start of the operation of NPP Temelín,
d) parallel affection of both males and females.

Upon cursory view, the incidence of the total number of tumours may appear in compliance with the above-specified criteria. However, a number of facts mentioned above contradict the potential causal influence of NPP Temelín. First of all, the duration of exposure of the population with respect to the duration of the existing operation is too short; according to the generally accepted scientific information, the process of carcinogenesis requires a longer time. Rich diversity of the results in the districts also applies to the control areas, some of which achieve the levels of the exposed districts. The idea of the unfavourable effect of NPP Temelín is also contradicted by the fact that in the operational period, one of the more distant exposed districts has high incidence, while the incidence in the other district is low. It is also reliably proved that the only effect of nuclear facilities on the tumour incidence specified in the literature, i.e. clustering of leukaemia and other neoplasms of the lymphatic tissue at the childhood age, is not present in the neighbourhood of NPP Temelín. In view of that fact, the detected levels of the total number of tumours and their statistical relations cannot be considered to be the effect of the NPP Temelín operation.

In the case of all individual tumours, the independence of their incidence on the neighbourhood of NPP Temelín is quite obvious. In addition to several partial features that might meet the above-specified criteria for some tumours, the great number of established results are clearly independent on the location of the area in relation to NPP Temelín. For the major part of tumours, even the significant results are paradox from this point of view, i.e. with more favourable incidence in the vicinity of NPP Temelín than in the more distant neighbourhood, with the more favourable situation during the time of operation and the discrepancy between the results obtained for males and females. Such signs are found for tumours of the stomach, large intestine, rectum, lungs, prostate, bladder, kidneys as well as the urinary system as a whole. Like we cannot declare these signs to be the impact of the favourable effect of NPP Temelín, the mere compliance with some criteria, on the other hand, cannot be considered as an unfavourable effect.

Many irregularities and ambivalence of the results are caused by the fact that the monitored period of operation is still too short and, in connection with that, the number of cases is low. It may be reasonably assumed that as the time of monitoring prolongs in the following years, the results will be more regular and reliable.

C.2.1.2.4. Reproductive process disorders

In the neighbourhood of nuclear facilities there are sometimes also fears of potential impacts on the reproductive process (procreation) among the population. Although such type of damage in the assessed conditions is extremely improbable, it is monitored and evaluated with respect to the above-mentioned fears.

For that purpose, there are two indicators selected among the nationwide registered data; the incidence of miscarriages and the incidence of infants with birth weight under 2,500 g. Among other potential indicators, it was impossible to use the incidence of congenital defects, for which the number of reported cases is low (about 20 per 1,000 live-born infants), while the report may be incomplete (due to the fact that some congenital defects are not obvious right after birth). Besides, the congenital defects should be divided according to type in processing (they have various causes). Also the incidence of multiple births (twins, triplets, quadruplets) is out of the question due to small numbers (about 10 per 1,000 births). For other potential indicators (sexual dysfunction, sperm abnormalities, fertility disorders) there are no records available.

C.2.1.2.4.1. Miscarriages

Indices of miscarriages (numbers of miscarriages per 1,000 live-born infants) in the exposed areas range significantly below the national average. The evaluation of significance of mutual differences between the pairs of indices in the exposed and control areas show that the differences are statistically insignificant in the pre-operational period, while in the operational period the indices in exposed areas are significantly lower than in the KP control area. No signs of increased miscarriages in the exposed areas were discovered compared to the control areas.

C.2.1.2.4.2. Infants with low birth weight

Indices of infants with low birth weight under 2,500 g (in recalculation per 1,000 live-born infants) range mainly at the level of the national average in the exposed areas; they slightly exceed it in area E1 in the operational period. The evaluation of significance of mutual differences between the pairs of indices in the exposed and control areas indicates that in the pre-operational period the incidence in the exposed areas was significantly lower than in the KP control area, and the significant results disappeared in the operational period and there is no difference regarding this indicator between the exposed and control areas. No signs of the increase in the incidence of the infants with low birth weight were discovered in the exposed areas compared to the control areas.

C.2.1.2.4.3. Discussion on the results

Among the two selected indicators, the incidence of infants with birth weight under 2,500 g is more reliable. As for the miscarriages, there are problems with uniform detection rate, since some of the cases are not reported and sometimes not even diagnosed. Regarding the results, we can say that no signs of the potential unfavourable effect of NPP Temelín were found for the monitored indicators of the reproductive process disorders; on the contrary, more favourable results were proved in some cases in the vicinity.

C.2.1.2.5. Overall evaluation and conclusions

The health of residents in the neighbourhood area of the NPP Temelín is continuously assessed based on the available data, with the focus on potential impacts of the power plant construction and operation. As a whole both the pre-operational period (from the beginning of the 1990s to 2001) and the operational period (from 2001 to the last year with the available records, i.e. 2006 or 2007 as the case may be) are evaluated. For the above-specified periods and for the selected close (“exposed”) and more distant (“control”) areas and districts the age-standardised characteristics of seven mortality rate indicators and incidence of 11 types of malignant tumours were calculated. The incidence of leukaemia and some other malignant tumours of the lymphatic system in the childhood age were evaluated separately. The indices of the incidence of two signs of reproductive process disruption (miscarriages and infants with low birth weight) were processed for the same periods and areas.

The survey of health condition, performed by the Department of Preventive medicine of the Faculty of Medicine of Masaryk University in Brno (which was used for the data presented in this documentation), is based on the assumption that public health might theoretically be affected by psychological effects in connection with certain fears shared among the public and by the effect of radioactive nuclides which are released in traces to air and water.

In the first (pre-operational) period only the first effect could have acted. It was the period of the completion of construction and the start of the test run of the power plant as well as the demographic changes in connection with the social effects of NPP Temelín on migration of the population and its living standard and last but not least the period of extensive social and economic changes as a result of the transfer to market economy in the Czech Republic after 1989. Already during the construction the population was definitely affected by a series of impacts, not only negative (destruction of municipalities, disturbance of psychological well-being as a result of evoking exaggerated fears of potential harmful effects), but also positive (social benefit for the neighbourhood - higher employment rate, higher material level, higher level of services etc.). All those effects may act to a various extent in the background of some health shifts that were detected during the period.

The second (operational) period of the power plant is still relatively short. The social and economic effects of NPP Temelín, as well as the above-mentioned psychological effects, might have kept acting. They are accompanied by the release of trace amounts of radioactive nuclides. The effect of ionising radiation might theoretically prove by the carcinogenic effect, however after a longer period of time. Besides, it should be mentioned that despite numerous scientific studies in the neighbourhood of over one hundred nuclear facilities in various countries, no such effect has been proved during normal operation.

The partial results are described in individual chapters above; below the two basic results that follow from the health evaluation are summarised.

1. In neither of the compared periods and in no health indicator were any proof of potential negative health effects on the population in the neighbourhood of NPP Temelín discovered. The established changes and variations of health parameters, both favourable and unfavourable, exist randomly in the evaluated areas, without an obvious and congruent relation to NPP Temelín.
2. Although the individual monitored areas and districts do not differ significantly from each other in terms of the living and social conditions, the considerable, statistically significant differences were often discovered for all monitored health indicators. Also the extent of internal differentiation of the areas which surfaced in separate evaluation of individual districts is unexpectedly high.

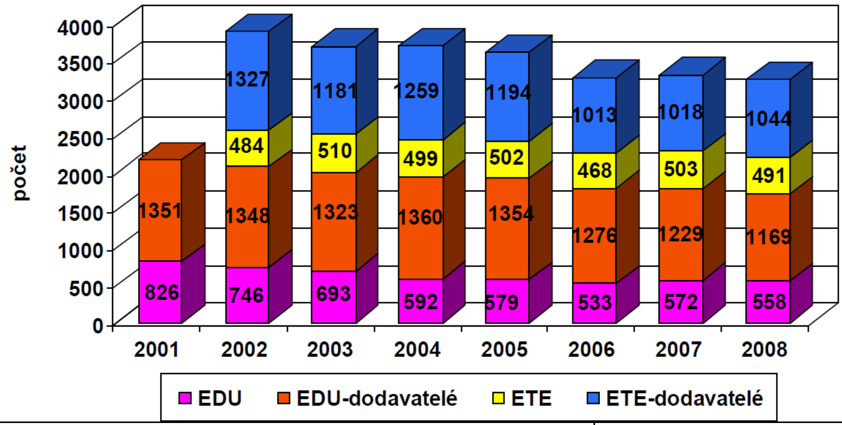
It is not easy to describe the causes of the established differences in mortality rate and other health indicators among the areas and districts. The health phenomena, which are continuously monitored (deaths, cancer, cardiovascular diseases, miscarriages, infants with low birth weight), do not have a single cause. A large number of various determinants participate in their formation and development, mainly in the way of living (improper food composition, smoking, alcohol, low mobility and related obesity, stresses and many others) and probably also the environment (chemical release, pollution, natural ionising radiation etc.). To a certain extent these factors are connected to the place of residence, its social environment and local health and cultural traditions and influences. Each difference in health parameters among the areas must therefore be understood as a result of a very complex, complicated and hardly palpable set of various causal factors. From that point of view a lot of obvious differences between the areas must be understood.

C.2.1.2.6. Monitoring of effects on the power plant personnel

Monitoring of effects on the personnel (the problems of occupational hygiene) is handled in accordance with the applicable legislation by the respective sanitary inspection bodies (non-radiation effects) possibly by the State Office for Nuclear Safety (radiation effects). The data specified in this document are thus of informative nature only.

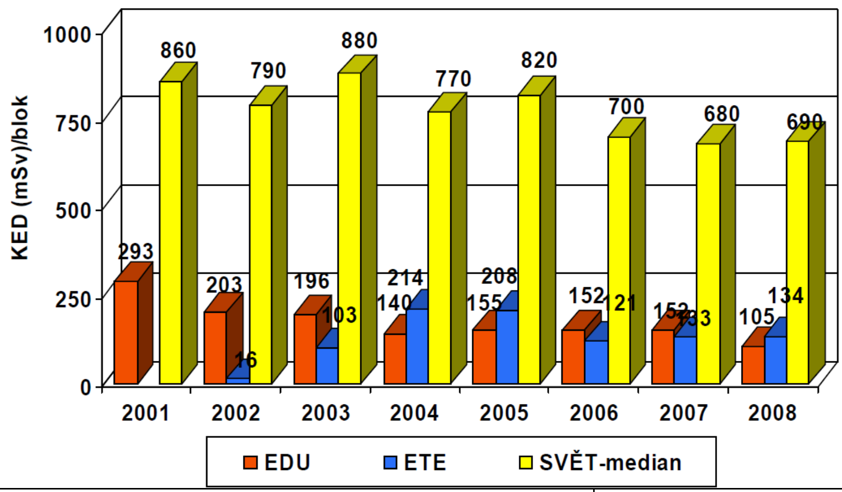
The following figures show the data on the number of employees and collected doses in 2001 to 2008. The data are for both nuclear power plants - Temelín (NPP Temelín) and Dukovany (NPP Dukovany).

Figure C.2.5: Numbers of monitored employees of NPP Temelín and NPP Dukovany



Počet	Number
EDU	Dukovany PP
EDU dodavatelé	Dukovany PP suppliers
ETE	Temelín PP
ETE dodavatelé	Temelín PP suppliers

Figure C.2.6: The overall collective effective dose/block, comparison with the world



KED (mSv)/blok	CED (mSv)/block
EDU	Dukovany PP
ETE	Temelín PP
SVĚT-median	WORLD-median

Note: FD for IED ≥ 0.1 mSv, value of CED/block per 2008 for WORLD-median is only for Q 1-3 of 2008

It is obvious from the data that the radiation protection of both nuclear plants' employees is on a high compliance level with the requirements of the control body (SONS) and deep below the achieved global level of doses.

C.2.1.3. Psychological condition of the population

C.2.1.3.1. Psychic condition of the population

In the nuclear power plant Temelín area, three studies comparing the state of psychic stability, level of living satisfaction and on the contrary the presence of fears and anxieties among the inhabitants from the vicinity of the power plant compared with the distant control area were performed. The last of them provides the summary of the results from the above-mentioned studies (Kebza, E. et al., In: Zdravotní stav obyvatelstva v oblasti jaderné elektrárny Temelín - Public health in the nuclear power plant Temelín area. Masaryk University in Brno, 2004).

The first study was performed in 2000, in the period right before the start of the launch of the nuclear power plant when the protests of its adversaries culminated. The results did not show substantial changes in the characteristics of the compared sets (exposed and control); slight differences rather showed a higher level of mental stability, living satisfaction, trust in their own capabilities, awareness of responsibility and level of self-realisation in the case of the Temelín population.

The second study was performed in 2002, at the time of gradual ramp of the power plant operation, accompanied by frequent minor problems of technical nature widely commented in the media. It was also ushered in by the August floods, which affected the Czech Republic and which due to a relatively short time interval from the field study proper might have affected its results mainly by the all-society experienced (and intensively monitored by the media) atmosphere of extraordinary peril. Even the above-mentioned extraordinary circumstances did not change the previously favourable trends. If differences were found in the results of the survey between the South-Bohemian and control set, they were always in favour of the South-Bohemian (Temelín) set. It was possible to state that the general favourable evaluation of the quality of intellectual life of the Temelín population, which when compared to the control set did not show an influence of the power plant completion and start of operation, and after the two years, that the evaluation was relatively stable and it was also quite significantly resistant to extraordinary and unexpected events.

The third study from 2004 included the period of the test run of the power plant and its transfer to full output, without any extraordinary events. The comparison between the Temelín population set and the control set of the East Bohemia population clearly showed both a significantly higher percentage of the respondents who did not specify any reasons of life dissatisfaction (73.1% of the Temelín population compared to 60.9% of the control set population), and a significantly lower number of specified causes of life dissatisfaction in the case of the Temelín population. The Temelín set proved a statistically significantly lower level of neuroticism, lower level of depressive states, higher level of satisfaction with one's own life and the level of its experiencing. That way the previously established trends were proved, that showed similar or rather more favourable results applied to the quality of intellectual life of the Temelín population as a result of accepting the existence and operation of the power plant by the population as the reality, adequately reasoned and explained in accordance with the principles of well-calculated risk, the extent of which is evaluated by the vast majority of the region's population as acceptable and tolerable.

The described relatively high level of the quality of intellectual life of the Temelín population cannot be considered as given and unchangeable once and away. Compared to the control set, the latest study included 12 items out of 13 that were assessed more favourably in the favour of the Temelín population, but the result was opposite for one item. A lower level of trust in one's own capabilities, self-confidence and conviction of one's own responsibility was detected. The authors of the study evaluated this by the fact that the inhabitants of the Temelín neighbourhood have a lower level of the opinion that they have full control over their lives. It may be evoked by the existence of the power plant and following fatal belief that an extraordinary event in the power plant is outside the area they can affect or possibly correct by their activity. The above-mentioned finding signals that the stated stability is still just subtle and that any extraordinary event connected to the power plant operation, possibly to nuclear power in general may disrupt the stability. These attitudes may be weakened and gradually eliminated by the long-term failure-free operation of the power plant.

C.2.1.3.2. Attitudes of the population

The attitudes of the population of the Czech Republic to the energy concept, power engineering and the project that are based on the report from the opinion poll (Temelín 2009 - The Energy Concept. STEM - Centre for Empirical Research, Prague, March 2009) are summed up as follows:

- Energy self-sufficiency, eliminating the risk of dependency on foreign energy sources, and the possibility of the Czech Republic as the sovereign state to decide on its energy policy - are the unambiguous priorities of our state's energy policy in the opinion of the majority of citizens. That opinion was further boosted by the crisis, precipitated by the disturbance of deliveries of Russian gas via the Ukraine to central and southeast Europe in January 2009.

- In the last two years a slight deflection of the Czech public from renewable resources is obvious. The number of supporters of the import of electric power has also dropped. On the other hand the share of people who think that the significant part of electric power production should be covered by nuclear power engineering has increased since the last year.
- A half (51%) of the people think that the largest share in the production of electric power in the Czech Republic should be met by the energy from nuclear blocks by 2030. Another 36% of people consider renewable resources the main energy pillar in the prospect of 2030. Only a few percent of the Czech population attach the decisive share in power production by 2030 to conventional fuels (gas, coal).
- Almost all groups of the population attach the main role in the energy policy of the country to nuclear power engineering. Among the supporters of parliamentary parties, this position is advocated mainly by the supporters of the Civic Democratic Party (ODS), but nuclear power engineering also has strong support among the supporters of the Czech Social Democratic Party (ČSSD). The supporters of the Green Party are the strongest advocates of the decisive share of renewable resources, although two fifths among them also prefer nuclear power engineering to renewable resources.
- The support of further development of nuclear power engineering has increased by 10 percentage points (from 59% to 69%) when compared to 2007. The support of the construction of new modern blocks in Temelín or Dukovany is also very strong (72%). At the same time, the number of people who think that the production of electric power from nuclear power plants might be met from other resources has decreased (to the current 42%).
- The majority of the Czech population, even the majority of the people who disapprove the further development of the nuclear power engineering in our country in general, recognise all introduced arguments in favour of a further increase of the share of nuclear power engineering (devastation of the environment by coal mining, production of CO_2 from thermal plants and potential dependency on the deliveries of oil and gas) as strong arguments.
- Over three thirds of people (79%) think that NPP Temelín is comparable to the modern nuclear power plants in the world and the same share of our citizens (78%) considers its operation safe.
- 69% of people would agree with the full completion of NPP Temelín and the launch of new blocks in a potential referendum. If only those who declared their participation would take part in the referendum, 77% of the citizens would vote for the completion of NPP Temelín. The interest in the participation in the referendum is stable in the long-term and it ranges around 70%.
- It follows from the combination of questions regarding the general support of further development of nuclear power engineering in our country and the support of the completion of NPP Temelín that, at present, two thirds of the adult population can be considered to be strong supporters of nuclear energy while the resolute adversaries of nuclear energy form about one fourth of the adults.
- The share of people in whose opinion the operator of NPP Temelín acts openly towards the public is slowly increasing and it has already exceeded the fifty-percent boundary. However, the opinion still persists among the public that ČEZ provides little information regarding its power plants, even among the people who are trying to obtain information on the operation of nuclear power plant Temelín by themselves.

C.2.1.4. Social and economic characteristics

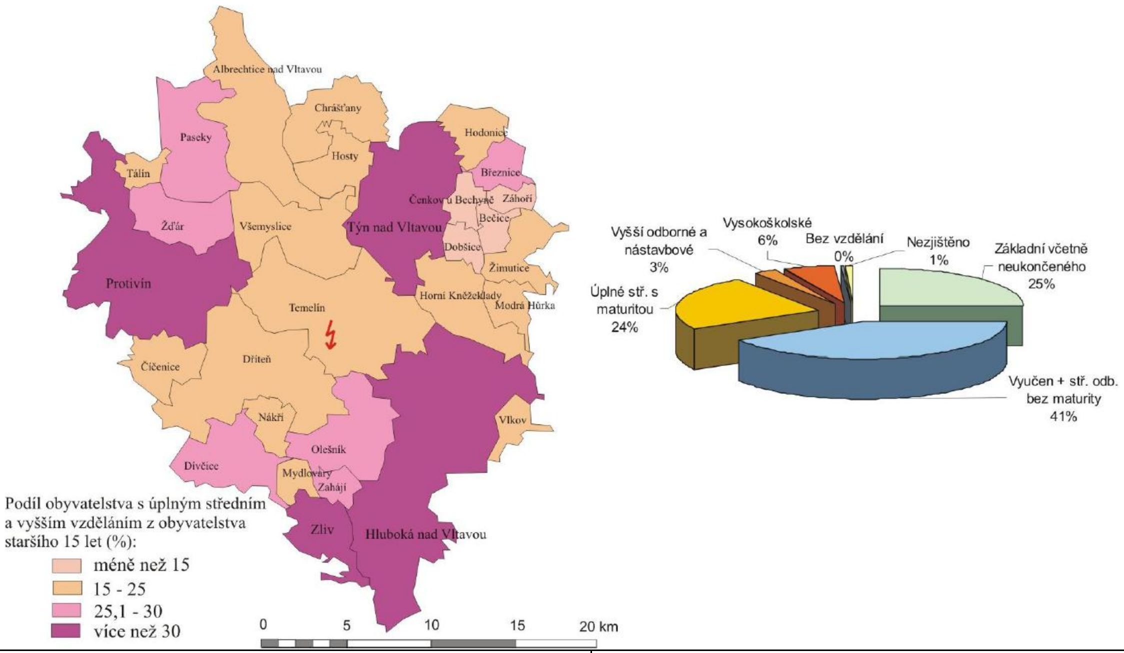
C.2.1.4.1. Structure of the population

Out of the total population of the Temelín area of interest, 4,980 persons were in the pre-productive age (0-14 years old), 20,271 persons were in the productive age (15 to 64) and 4,373 persons in the post-productive age (65 and over) (the data for 2008). In terms of the age structure, the local population can be marked (unlike the total situation in the Czech Republic) as slightly progressive, since the child component prevails slightly over the post-productive component. The cause of this progressive age structure can be found in the non-standard structure of the population of Týn nad Vltavou, where the builders and employees of the Temelín Power Plant migrated most often in the 1980s and 1990s (at the start of their economic activity) and many of them settled in the town and found their families. Today, they are still in the productive age and their children increase the share of the pre-productive population significantly.

The percentage of the age category 15-59 years in the area of interest ranges from 61 to 77% in the set of the respective municipality population. The municipalities with the regressive age structure (the lowest share of the productive and, at the same time, the highest share of the post-productive component of the population) can be marked as the most endangered by the aging - Hosty, Horní Kněžeklady, Záhoří; Dříteň and Zahájí are among the “youngest” municipalities in addition to Týn nad Vltavou.

The presence of an educated population is one of the important development factors of the area. During the last census (2001), 6,233 persons with primary education (including unfinished) were established among the population over 15 in the municipalities of the Temelín area; 10,488 undertook apprenticeship or had secondary vocational education without a school-leaving certificate, 5,940 finished secondary education with a school-leaving certificate, 671 persons graduated from higher-vocational schools and follow-up study and finally 1,417 persons from the university. 65 persons were completely without education; the education was not established with one percent of the population. After a detailed analysis of the available data on the local level (see the following Figure) it can be said that the last favourable situation regarding the education of the population is in the municipalities under 300 inhabitants. Those municipalities are characteristic in the above-average share of the population with primary education, apprenticeship and secondary vocational training without school-leaving certificate in the micro-regional aspect and at the same time in the below-average share of the population with higher education. The population with a higher level of education traditionally concentrates in towns (all four towns of the area of interest have over one third of their population with at least full secondary education with a school-leaving certificate), with a certain degree of tolerance also in the villages in its vicinity.

Figure C.2.7: The selected characteristics of educational structure of the population in the Temelín area



Podíl obyvatelstva s úplným středním a vyšším vzděláním z obyvatelsva staršího 15 let	Proportion of population over 15 years of age with complete secondary and higher education
míně než 15	less than 15
více než 30	more than 30
Úplné stř. s maturitou	Full high school with matriculation
Vyšší odborné a nadstavbové	Higher vocational & extension
Vysokoškolské	Tertiary
Bez vzdělání	No education
Nezjištěno	Unknown
Základní včetně neukončeného	Elementary including Incomplete
Vyučen + stř. odb. bez maturity	Skilled artisan + middle vocation w/out matriculation

The nationality structure of the population in the area shows significant homogeneity, although it applies to the frontier region. The vast majority of inhabitants admit Czech nationality; only less than 5% specified a different nationality or did not specify any. Slovaks, with 357 members present in 23 municipalities, are the most numerous minority. Their absolutely highest share (1.8% of the population) during the 2001 census was in Týn nad Vltavou, which is another demonstration of the effect of the Temelín Power Plant (recruitment of employees took place at the time of the existence of Czechoslovakia). Less than 1% of inhabitants admit other nationalities (German, Romany, Moravian, Vietnamese, Ukrainian); the nationality could not be found for 2% of inhabitants.

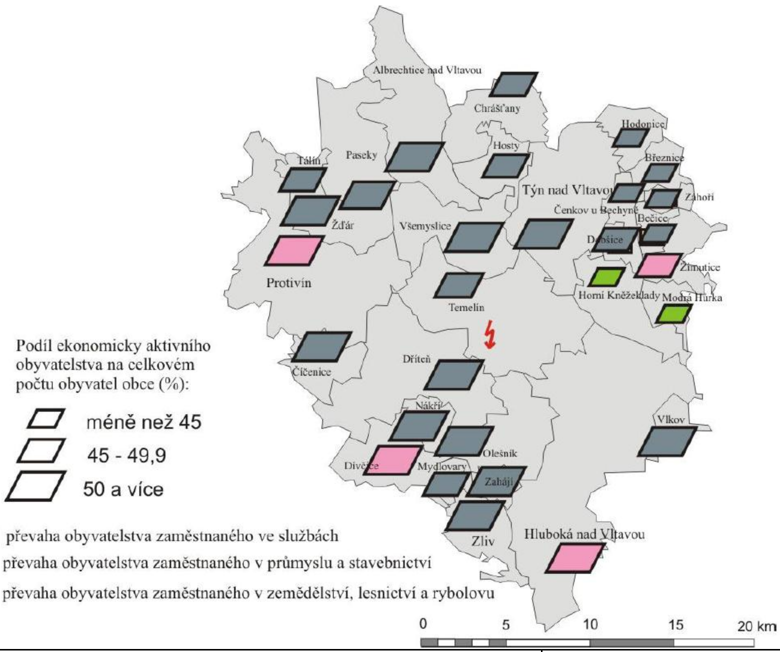
Within the Czech Republic, the Temelín area can be labelled as religious slightly above the average, since 51% of the inhabitants are non-denominational (Czech Republic 59%). 14% did not specify their attitude to religion (Czech Republic 8%), which is the category generally matched with the non-denominational population. The Roman Catholic Church is the most represented denomination (88.6%), the followers of the Czechoslovak Hussite Church and the Protestant Church of Czech Brethren include several tens of people; other usual churches are represented only by individuals.

C.2.1.4.2. Economic activity of the population

At the time of the census (2001) there were 15,116 economically active inhabitants in the Temelín area of interest, which is 49.3% of the total population. 10.6% of economically active people were employed in the primary sector (agriculture, forestry, fishing). For the entire area of the Temelín municipalities this value is higher compared to the national data. The remaining two sectors (secondary and tertiary) are represented equally in the area. Insignificantly more economically active inhabitants work in industry and civil engineering, 45.0%, than in services (trade, machinery maintenance, transport, telecommunications, public administration, defence, social security, education and health care), 44.4%. That means that the Temelín area is mainly the centre of employment in the secondary and tertiary sector, however the significance of employment in agriculture, forestry and fishing is twice as high as the national average. This result is appropriate to the character of the region, which can be specified as the rural background of the regional town with micro-regional centres of small towns.

The evaluation of the economic activity of the population shows (see the following figure) that the highest share of the economically active inhabitants on the local level is in the municipality of Nákří (65.7%), while the smallest is in Modrá Hůrka (37.0%) with agricultural orientation. The most balanced representation of the economic activity in all three sectors is in Žďár and Vlkov. The smallest economic activity in agriculture, forestry and fishing is reported by Týn nad Vltavou, where the substantial part of the Temelín Power Plant employees come from (included in the category of industry and building industry) and where the sector of services is strongly developed.

Figure C.2.8: Economic activity of the population in the Temelín area, 2001



Počet ekonomicky aktivního obyvatelstva na celkovém počtu	Ratio of economically active town's population per town's total

obyvatel obce	population
Méně než 45%	Less than 45%
50 a více	50 and more
Převaha obyvatelstva zaměstnaného ve službách	Majority of population employed in services
Převaha obyvatelstva zaměstnaného v průmyslu a stavebnictví	Majority of population employed in industry and construction
Převaha obyvatelstva zaměstnaného v zemědělství, lesnictví a rybolovu	Majority of population employed in agriculture, forestry and fishery

In the Temelín area, the total of 10,202 economic subjects is registered (as at 31 December 2008), out of which only 75.2% of business subjects are active (7,676 subjects). Among the specified number there are 5,116 sole traders, i.e. natural persons conducting business based on trade law. The highest concentration of active economic subjects can be found in towns - Týn nad Vltavou (35.4% economic subjects from the whole area), Hluboká nad Vltavou (24.8%), Protivín (20.8%) and Zliv (14.1%). On average, 24 persons out of 100 inhabitants with permanent residence conduct business actively.

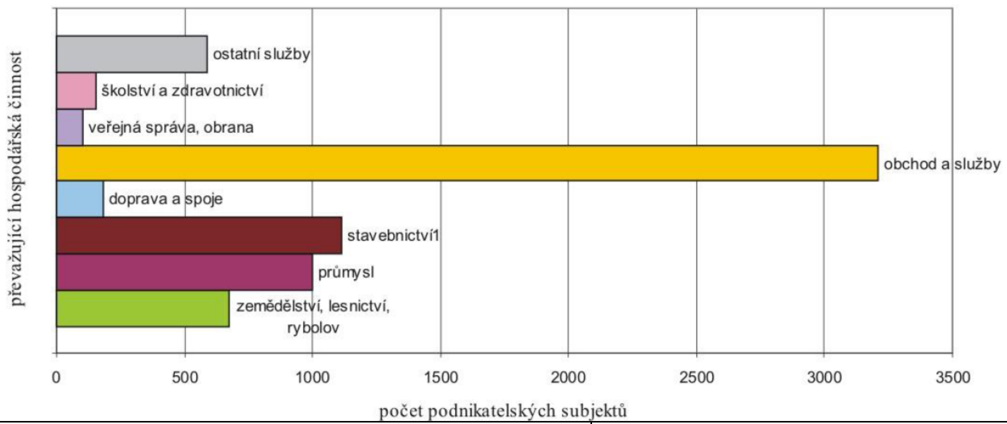
The number of business subjects in the neighbourhood of the Temelín Power Plant and the trend in their numbers is obvious from the following table.

Table C.2.1: Total number of business entities

Municipality	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Dříteň	116	141	152	167	185	201	213	223	229	236	239	245	246	258
Olešník	75	83	86	91	107	115	120	131	134	141	165	137	140	148
Temelín	124	131	142	151	170	176	181	177	177	179	180	183	190	188
Týn nad Vltavou	1,121	1,274	1,389	1,487	1,633	1,707	1,779	1,778	1,817	1,815	1,804	1,780	1,769	1,792
Všemyslice	125	149	163	177	184	194	211	215	219	227	233	233	232	231

The most registered business subjects (45.6%) are in the category of trade (sales and repairs of motor vehicles, hotel industry) and services (other commercial services). The business activity of trade and services is represented In each municipality in the area of interest. Almost one fourth of the business subjects in this category can be found in Týn nad Vltavou (broadly tertiary developed town with the background) and in Hluboká nad Vltavou (focus on services in tourism). The centripetal force of business subjects in connection with trade and services in Hluboká nad Vltavou should be specifically noted, since only 17% of the inhabitants of the area live there.

Figure C.2.9: Structure of registered business subjects in the Temelín area as at 31 December 2008



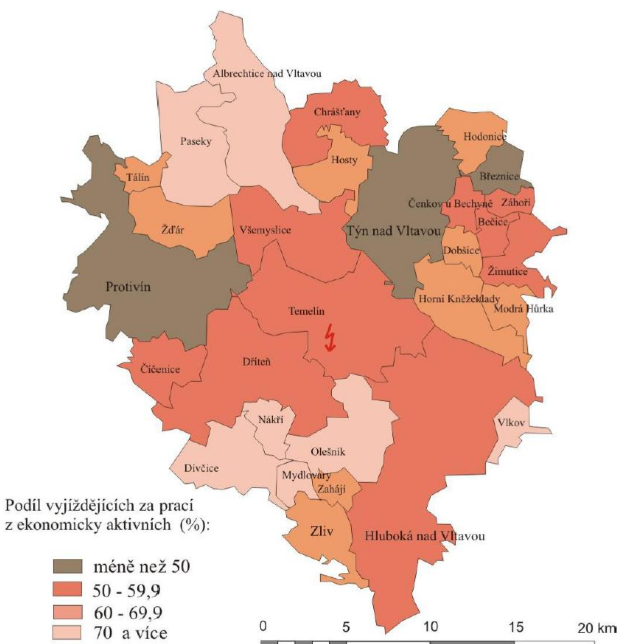
Převažující hospodářská činnost	Dominant economic activity
Počet podnikatelských subjektů	Number of entrepreneurial subjects
Ostatní služby	Other services
Školství a zdravotnictví	Education and health
Obchod a služby	Trade and services
Veřejná správa, obrana	Public administration, defence
Doprava a spoje	Transport and telecommunications

Stavebnictví	Building industry
Průmysl	Industry
Zemědělství, lesnictví, rybolov	Agriculture, forestry and fishing

An almost identical number of business subjects are shared by the categories of industry (14.2%) and building industry (15.8%). The representation of these business subjects related to the number of inhabitants of individual municipalities is more or less even in the whole area; isolated anomalies appear in the smallest municipalities, where the resulting shares are affected by one to two subjects. An interesting situation is in the sector of agriculture, forestry and fishing where 674 business subjects are registered with regionalisation corresponding to the above-specified evaluation of the economically active in the sector. The business subjects in transport and communications are registered in two thirds of the municipalities in the area under survey with two thirds of them concentrated in four towns. The representation of business subjects in schools and health care copies the distribution of educational facilities (2/3 of municipalities, more specifically see the part dealing with tertiary services); as for the healthcare services it is completed with the subjects providing home treatment and care etc. The business subjects of public administration are represented in all municipalities, which follows from the very substance and functioning of a municipality as an administrative unit; the highest figures in absolute numbers are achieved by towns; in relative numbers by the municipalities of Chrášťany, Temelín and Dříteň.

The majority of economically active people are employed right in their place of residence. 46.0% of them commute to work outside the municipality, which is not a significant problem in a region which is densely populated and has satisfactory transport services. Also 2,684 pupils, students and apprentices commute. It can be assumed that the strongest commuting intra-regional stream goes to the Temelín Power Plant, which is located in the cadastral district of Temelín; other centres of commuting will include all four towns and also České Budějovice, Vodňany, Písek and Bechyně for the peripheral municipalities of the examined area. Besides, 43.5% of commuters travel a distance shorter than 30 minutes, another 48.2% a distance of 30 to 59 minutes and only 8.3% a distance of one hour or longer. The average time of commuting can be estimated to 35 minutes, which is quite bearable.

Figure C.2.10: Commuting to work in the Temelín area, 2001



Podíl vyjíždějících za prací z ekonomicky aktivních	Proportion of work commuters from economically active population
Méně než	Less than
70 a více	70 and more

C.2.1.4.3. Unemployment

The trend in the registered unemployment rate in the affected area can be seen in the following table.

Table C.2.2: Total registered unemployment rate for applicants - total [%]

Municipality	2000	2001	2002	2003	2004	2005	2006	2007	2008
Dříteň	3.83	5.51	5.51	5.67	4.90	7.04	4.59	4.29	4.00
Olešník	1.94	4.17	1.67	3.33	4.72	4.17	3.61	3.61	5.00
Temelín	4.58	4.30	4.87	6.59	7.45	10.03	10.32	5.16	9.00
Týn nad Vltavou	5.07	5.45	5.85	6.28	7.30	6.42	6.33	4.45	5.00
Všemyslice	5.21	5.01	5.21	6.41	7.82	8.62	6.01	4.61	4.00
South Bohemia Region	6.0	5.4	6.0	6.4	6.9	6.3	6.0	4.8	4.0

The data in the above-specified table show that the registered unemployment rate among the applicants in the municipalities surrounding the power plant is substantially comparable to the registered unemployment rate in the South Bohemia Region.

The deviation is due to the increased unemployment in Temelín in 2005 and 2006, as a result of the breakup of the local farm cooperative. The local building company later hired approximately 70% of the dismissed employees. The increase of unemployment in 2008 is a result of general depression.

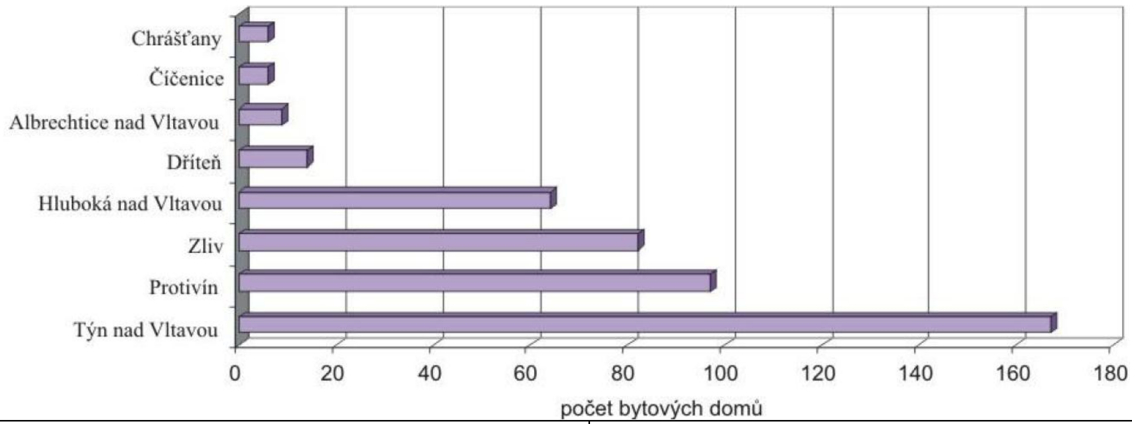
C.2.1.4.4. Housing

During the last people, houses and apartments census in 2001 there were 9,989 houses in the area, out of which 13.1% were uninhabited and 16.0% were used for recreational activities. The municipalities of Paseky, Hodonice, Záhoří, Žďár, Vlkov and Albrechtice nad Vltavou have the most houses used for recreation (more than 1/3).

In the Temelín area housing there are 14,085 flats, out of which 73.9% are inhabited permanently. 60% of them are located in family houses, the rest in blocks of flats. Only in Týn nad Vltavou and Zliv do flats in the blocks of flats prevail; in Týn nad Vltavou there are 75% and in Zliv 57%. The permanently uninhabited flats may be uninhabited temporarily, used for recreation, or are partly inappropriate for living or under reconstruction. A 100% representation of flats in family houses can be found in Nákří, Bečice, Čenkov u Bechyně, Hodonice, Horní Kněžeklady, Modrá Hůrka, Vlkov, Zahájí, Záhoří and Paseky. The largest share of flats dates back to the post-war and socialist period. The blocks of flats were mainly built in the 1970s and 1980s while the pre- and post-socialist period is characteristic in the higher share of the housing development in family houses.

Out of 6,504 permanently inhabited houses there are 92.6% family houses, which also corresponds to 89.2% private ownership. The minority identified owners of the housing include the municipality or state (3.4%) and housing cooperatives (1.4%), while the category of cooperative flats is most common among the blocks of flats. The municipalities with the development of purely family houses include 10 municipalities (municipalities with less than 200 inhabitants; among the larger Zahájí and Horní Kněžeklady). In all other municipalities at least one block of flats is located, built mostly by an agricultural subject or a manufacturing plant in the socialist period. The vast majority of the total number of 480 blocks of flats was built in eight municipalities (see the following image); only in the towns proper there were 85.4% blocks of flats in the whole territory.

Figure C.2.11: Villages and towns with the highest number of blocks of flats in the Temelín area, 2001



Počet bytových domů	Number of blocks of flats

For the employees of the Temelín Power Plant who migrated to the region, the Hlinky housing estate with blocks of flats was built in Týn nad Vltavou. On the other hand, the villages and settlements of Březí, Knín, Křtěnov, Podhájí u Týna nad Vltavou a Temelínec disappeared in connection with the construction of the Temelín Power Plant.

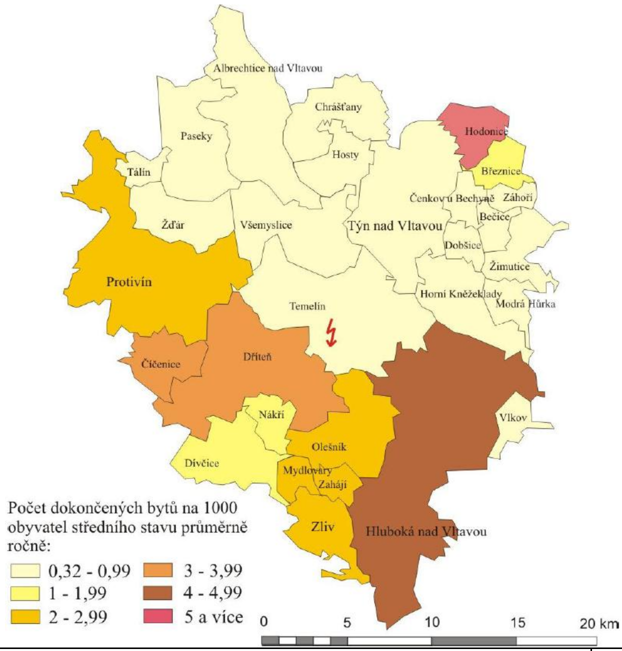
The housing structure, according to the period of construction, copies the situation in the Czech Republic with variations of a max. two percentage points. The oldest development concentrated mainly to the rural environment of small agricultural villages. In general, in the Temelín area there is a higher, almost one-fifth share of housing built before 1920. Approximately a thousand houses date back to the period of 1920-1945, which means that every sixth house in the Temelín area was built in the semi-war period. Two fifths of today's houses were built between 1946-1980. They also include the first blocks of flats in the area. In the town of Zliv and villages of Olešník and Zahájí, more than 50% of the permanently inhabited housing includes houses from this period. The newest evaluated era includes the period between 1981-2001, when approximately one fourth of the existing permanently inhabited houses were built. Všemyslice, Týn nad Vltavou (repeated connection withTemelín Power Plant) and Hluboká nad Vltavou (for all of them the share of development is close to or slightly exceeds the 30% border) became the centres of construction in that period.

The height parameters are another significant characteristic of the housing. Naturally, the development of 1 and 2 storey houses (92.27%) prevails in the Temelín area. Still there are also 3 and 4 storey houses in almost all municipalities, amounting to tens of them in the towns. Five-storey and higher buildings are usually the indicators of urban type settlements, which in our case proves the existence of 96 such houses in Týn nad Vltavou, 31 in Protivín, 21 in Zliv, 16 in Hluboká nad Vltavou and two in Všemyslice and Čičenice and one in Temelín.

The quality of living environment can be characterised using the indicator of technological equipment of the houses, the level of housing is evaluated using the number of persons per permanently inhabited flat and average size of the living floor space per person. In the intercensal period such data are impossible to obtain; the specified values are thus based on the 2001 census and probably between 2001-2009 the technical equipment of the housing stock improved. In 2001, 70% of houses were connected to water mains, 44% to the sewerage system, 13% of houses to gas mains; one half of the houses are provided with central heating. It can be assumed that the majority of the incompletely technically equipped houses are located in neighbourhoods with a very small number of inhabitants. The number of persons per permanently inhabited flat ranges between 2.18 (Vlkov) and 3.4 (Čenkov u Bechyně) in the Temelín area. Both these municipalities are among the smallest in terms of the number of both inhabitants and flats, therefore it is more appropriate to specify 2.7 persons/flat as the characteristic of the area. In general, the relation applies that the number of persons per flat in the blocks of flats (especially on the housing estates) is higher than for family houses. It is also the reason for specifying another characteristic which includes the size of the living area of the flat per person. That is smallest in Týn nad Vltavou (18.25 m^2 per person) and Zliv (19.26 m^2 per person), in other municipalities of the Temelín area it most often ranges between 20-22 m^2 per person.

The attractiveness of the municipality in terms of housing can be evaluated based on the new housing development. The comparison of the data from comparative periods 1997 and 2007 showed that the most attractive municipalities include Hodonice (suburban zone of Bechyně, however in view of the population the absolute numbers apply to several flats mostly created by the reconstruction of a part of a farmhouse) and Hluboká nad Vltavou (thanks to an important link to České Budějovice). The above-average values (3-4 newly built flats a year per 1,000 inhabitants) are shown by Dříteň and Čičenice, the average values (2-3) are achieved by other municipalities with the centripetal force of the regional town. However, most of the area of Týn nad Vltavou showed a max. of one built flat a year. At present, high building activity can be seen in Hluboká nad Vltavou (on the bank of Munický pond), in Dříteň, in the neighbourhood of Neznašov (municipality of Všemyslice) and in other places.

Figure C.2.12: Intensity of the housing development in the Temelín area, 1997-2007



Počet dokončených bytů na 1000 obyvatel středního stavu průměrně ročně	Number of finished flats per 1,000 middle class population per year
5 a více	5 and more

C.2.1.4.5. Tourism

The Temelín area is a part of the tourist region of South Bohemia which offers a large number of tourist destinations and attractions. The main tourist destinations include natural locations (the confluence of the Vltava and the Lužnice, the Židova gully, Radomilice marsh, the Písecké Mountains natural park etc.), are designed for sports, cognitive or recreational activities and the towns and villages with their historical and cultural monuments (the state chateau of Hluboká nad Vltavou, castle and underground of Týn nad Vltavou, St. Peter and Paul's Church in Albrechtice nad Vltavou, castles, chateaus, museums, etc.). They also include the information centre of nuclear power plant Temelín with the attendance of approximately 30,000 visitors a year (from both the Czech Republic and abroad).

The potential of tourism in the area is then understood as the result of the improvement of as many of the most complex range of the location conditions and preconditions for its further development as possible. The accommodation capacities are developed in its full range, from encampments and camp sites by the ponds and rivers to accommodation in private houses and boarding houses to luxurious hotels.

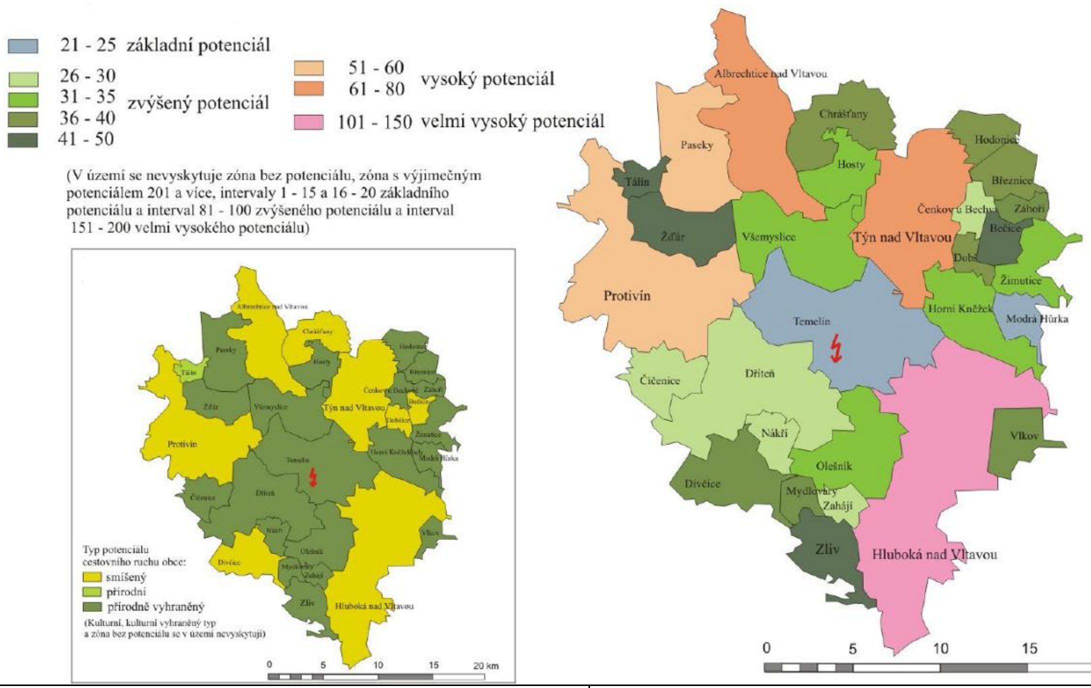
In general, in terms of tourism the Temelín area is a region suitable for:

- bicycle touring (slightly dissected hilly relief with streams, a large number of ponds, suitable side and back roads, diverse countryside with frequent alternation of woods, farming and meadow landscape),
- hiking (sufficient network of suitably marked off-road paths, nature trails, scattered vistas, technical monuments and other attractions, diverse terrain, possibility to combine with non-conventional types of transport, e.g. water transport),

- water tourism (a section of the Lužnice River favourite among water sportsmen, holiday boats as well as seasonal liners on the Vltava, canoeing, swimming, water-skiing, fishing, observation of waterfowls, rentals of sports equipment),
- cognition of cultural and historical monuments and sets (significant solitaire cultural monuments, particularities of the residential system - rural Baroque, religious countryside elements),
- attendance to the events from the rich cultural and sports calendar and congress tourism.

The potential of the Temelín area in tourism (see the following figure) is really varied. Only two municipalities belong to the zone of basic potential - the agricultural village of Modrá Hůrka and Temelín (insufficiently attractive natural subsystem, not the impact of the power plant, since - for comparison - the municipality of Dukovany with the neighbouring power plant ranks to the high-potential point interval 36-40). The majority of municipalities are in the zone of increased potential (like in the whole Czech Republic); its value is most often created by both natural and cultural subsystems of tourism, but more likely on the regional significant level (characteristic Czech slightly undulating type of countryside). The situation is different for the high-potential zone which includes small municipalities in highland areas with the dominant component of the natural subsystem (e.g. Paseky) or the villages and towns with a significant element of cultural subsystem. The cultural potential is much more selective in spatial terms and is bound mainly to towns and larger villages. The zone of very high potential further stresses the above-mentioned; in the Temelín area it only includes Hluboká nad Vltavou (especially due to the romantic neo-Gothic chateau with a beautiful vista).

Figure C.2.13: The general potential of tourism and its types in the Temelín area



Základní potenciál	Basic potential
Zvýšený potenciál	Increased potential
Vysoký potenciál	High potential
Velmi vysoký potenciál	Very high potential
(v území se nevyskytuje zóna bez potenciálu, zóna s vyjímečným potecionálem 201 a více, intervaly 1 až 15 a 16 až 20 základního potenciálu a interval 51 až 100 zvýšeného potenciálu a interval 150 – 200 velmi vysokého potenciálu)	(the territory has no zone without a potential, a zone with exceptional potential 201 and more, intervals 1 to 15 and 16 to 20 of basic potential and interval 51 to 100 of increased potential and interval 150 to 200 of very high potential)
Typ potenciálu cestovního ruchu obce:	Type of town’s tourist destination potential:
smíšený	mixed

přírodní	nature
přírodně vyhraněný	nature specific
(Kulturní, kulturně vyhraněný typ a zóna bez potenciálu se v území nevyskytují)	(Cultural & cultural specific type and zone with no potential do not exist in the locality)

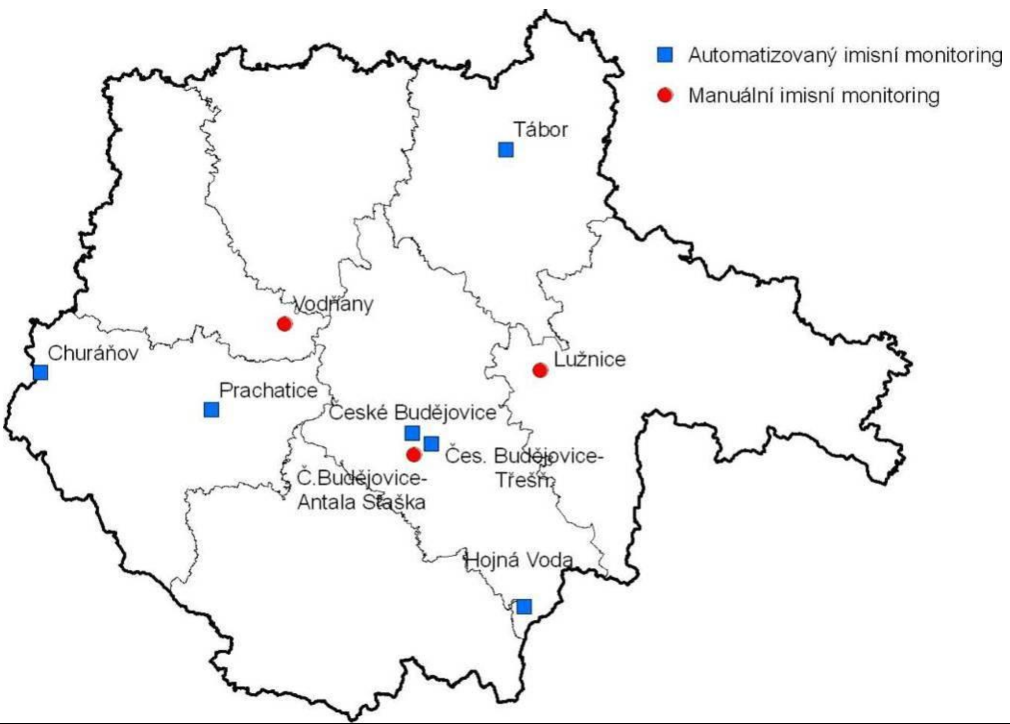
As a result of the typology of the general potential of tourism, the municipalities in the area of interest are divided to the naturally pronounced type (almost 100% representation of the natural subsystem component). Almost 70% of municipalities in the Czech Republic rank in this category, the same representation applies to the Temelín area. For the natural type the share of the natural subsystem is over 80%. For the municipalities with mixed potential the component of natural as well as cultural subsystems ranges between 40-60%. In view of the fact that the visions of many municipalities become attached to tourism, they should show their interest in highlighting the attractions of the local nature and countryside, while, however, at the same time providing support to the local cultural values and satisfaction of tourists in terms of material as well as transport.

C.2.2. Air and climate

C.2.2.1. Air quality

The network of stations for pollution monitoring in South Bohemia comprises of a total 9 stations, three of which are located in the regional town of České Budějovice. With regard to good air quality in the region, the density of the station network is suitable. The location of monitoring points in South Bohemia is shown in the following figure:

Figure C.2.14: Pollution monitoring network in South Bohemia



Automatizovaný imisní monitoring	Automated pollution monitoring
Manuální imisní monitoring	Manual pollution monitoring

The following table shows the results for 2007.

Table C.2.1: Pollution concentration of pollutants, 2007 [μg.m^{-3}]

Pollutant/averaging time	SO_2		NO_2		PM_{10}		CO	Lead	Benzene
	24 h	1 h	Year	1 h	Year	24 h	8 h	Year	Year
Pollution limit	125	350	40	200	40	50	10,000	0.5	5
Čes. Budějovice - Antala Staška								0.006	
Čes. Budějovice - Třešňová	27.1	62.6	19.7	65.0	19.1	30.4		0.0045	
Čes. Budějovice	19.9	45.3	19.4	72.9	23.1	40.6	1,408.7		0.8
Hojná Voda	6.9	13.0	7.0	33.1	-	-			
Churáňov	6.2	10.4	5.0	26.2	13.0	16.0		0.0028	
Lužnice	-	-	13.5	-	-	-			
Prachatice	12.5	18.6	13.2	72.1	8.5	14.8	1,660.5		
Tábor	29.9	66.8	26.9	78.8	30.8	53.5	2,637.0		1.5
Vodňany	10.9	-	15.1	-	20.7	40.0			

Sulfur dioxide (SO_2)

Sulphur dioxide emitted as a result of human activity is created mainly through combustion of fossil fuels (mainly coal and heavy oils) and by the melting of ores with a sulphuric content. Volcanoes and oceans are the main global natural source; however, their share for the territory within EMEP (which the Czech Republic also comes under) was estimated to only 2%. The daily average pollution limit of 125 μg.m^{-3} may be exceeded on a max. three days a year. As it follows from the map in the Annexe, in 2007, the pollution limit was not exceeded anywhere in the neighbourhood of the place of construction of NNPP Temelín and the daily averages of concentrations for this pollutant are deep below the pollution limit.

In all monitored locations of South Bohemia, except Tábor, the decreasing tendency of air pollution by sulphur dioxide is obvious starting from the middle of the 1990s and the stagnating situation in recent years. The inter-annual variations are caused by dispersion conditions. In Tábor, where the monitoring station was put into operation at the end of 2003, the increasing tendency of SO_2 concentrations was detected at the beginning of the operation, while in 2007 a significant decrease was registered.

Nitrogen dioxide (NO_2)

In Europe, the emissions of nitrogen oxides are generated mainly from anthropogenic combustion processes when nitrogen oxide (NO) is created as a result of the reaction between nitrogen and oxygen in combusting air and partially also as a result of the oxidising of nitrogen from fuel. The main anthropogenic sources primarily include road transport (however, air and water transport have a significant share, too) and combustion processes in stationary sources. Less than 10% of total emissions of nitrogen oxides result from combustion directly in the form of NO_2. Nitrogen dioxide NO_2 is formed quite fast as a result of the reaction of NO with ground ozone or with radicals of HO_2, possibly RO_2 type. Natural emissions of nitrogen oxides originate mainly from soil, volcanic activity and from the formation of lightning. They are relatively significant in a global view; from the European point of view, however, they represent less than 10% of total emissions.

Only in the limited number of places the annual pollution limit of nitrogen dioxide is exceeded, mainly in the exposed locations of conurbations and large towns in terms of transport. Out of the total number of 182 locations in the Czech Republic, where nitrogen dioxide was monitored in 2007, the annual pollution limit was exceeded at 17 stations. This limit was exceeded in a total of 6 locations, out of that number at 5 stations in the capital of Prague and at one in Brno. All above-mentioned measurement points are significantly affected by transport. It can be assumed that the pollution limits can also be exceeded in other heavily exposed locations in terms of transport where the monitoring is not carried out.

It is obvious from the map in the Annexe, that the annual pollution limit was not exceeded anywhere in the neighbourhood of the NNPP and the concentrations, except for larger towns, are not higher than 65% of the pollution level. The situation between 1996 and 2007 does not show any significant tendency.

Solid pollutants of PM_{10} fraction

The particles contained in the air can be divided into primary and secondary. The primary particles are emitted directly to the atmosphere, both from natural and anthropogenic sources. The secondary particles are mainly of the anthropogenic origin and they are formed as a result of oxidisation and subsequent reactions of gaseous compounds in the atmosphere. In the Czech Republic, like throughout Europe, the majority includes the emissions from anthropogenic activity. The main anthropogenic sources may include transport, power plants, combustion sources (both industrial and household), fugitive emissions from industry, loading/unloading of goods, mining activity and construction work. Air pollution with suspended particles of PM_{10} fraction remains one of the main problems in ensuring the air quality.

The annual averages of PM_{10} concentration in the neighbourhood of the NNPP are at the level of a half of the pollution limit and in that respect this pollutant is not a problem. In the assessment based on the daily pollution limit, which can only be exceeded on a max. 35 days a year, the situation seems more problematic. The pollution limit was not exceeded anywhere in the area of interest in 2007, on a large part of the area, however, the concentrations are close to the pollution limit. A belt of increased concentrations along the roads between České Budějovice and Písek as well as an area in the neighbourhood of Týn nad Vltavou are especially marked.

In the Annex, the situation in PM_{10} concentration at the stations in South Bohemia between 1996 and 2007 is shown using thematic maps. The decrease of PM_{10} concentrations and subsequent stagnation can be seen at the stations of Churáňov and České Budějovice - Třešňová. At the other stations the situation got worse after 2000 and the daily average pollution limit was exceeded; the situation was the worst in Tábor.

Carbon monoxide (CO)

The anthropogenic source of air pollution with carbon monoxide includes the processes with incomplete combustion of fossil fuels. Those are mainly transport and stationary sources, especially domestic furnaces. In 2007, carbon monoxide was measured at a total of 45 locations in the area of the Czech Republic; at 3 stations in the territory of South Bohemia. At no station in the Czech Republic did the maximum daily 8-hour running averages of carbon monoxide exceed the pollution limit of 10 $mg.m^{-3}$. The highest daily eight-hour limit of 4.6 $mg.m^{-3}$ for the Czech Republic was measured in the location Ostrava - Českobratrská, which represents the so called hot-spot. However, the lower assessment threshold (LAT) wan not exceeded there either.

The situation in CO concentrations at the monitoring stations of South Bohemia from 1996 to 2007 is shown in the Annexe. The concentrations have a decreasing tendency and during the whole period they did not approach the pollution limit. In the neighbourhood of the NNPP location, carbon monoxide is not the pollution burden worth consideration.

Lead (Pb)

The majority of lead contained in the atmosphere comes from anthropogenic emissions which also include high-temperature processes, especially combustion of fossil fuels, production of iron and steel and non-ferrous metallurgy. The significant natural sources include weathering of rocks and volcanic activity. The concentrations of lead at all monitored locations in the territory of the Czech Republic are well below the pollution limit and do not even reach the lower assessment threshold (LAT). The situation in annual averages of lead concentrations in the area of South Bohemia region is described in detail in the Annex.

Benzene (C_6H_6)

The critical source of atmospheric emissions of aromatic hydrocarbons - mainly benzene and its alkyl-derivatives - includes especially exhaust fumes of petrol motor vehicles. Another significant source of emissions of these hydrocarbons includes losses by vaporisation during petrol handling, storage and distribution. The emissions from mobile sources equal approximately 85% of the total emissions of aromatic hydrocarbons, while the prevailing part is apportioned to the emissions from exhaust fuels. It is reckoned that the remaining 15% of emissions come from stationary emission sources, while the decisive share comes to the processes producing aromatic hydrocarbons and the processes where these compounds are used for production of other chemicals.

The researches show that the content of benzene in petrol is approximately 1.5%, while fuels for diesel engines contain relatively insignificant benzene concentrations. The benzene contained in exhaust fumes is mainly unburned benzene from the fuel. The benzene coming from non-benzenoid aromatic hydrocarbons contained in the fuel is another addition to the benzene emissions in exhaust fuels (70-80% benzene in emissions). The benzene in exhaust fuels is also partially formed from non-aromatic hydrocarbons.

In 2007 the benzene concentrations were measured at a total of 33 locations in the Czech Republic. The pollution limit is defined as the annual average concentration of 5 μg.m^{-3}. This pollution limit was exceeded only in the Ostrava region. Higher concentrations in that area are related to industrial activity, mainly to the coke production. At the overall majority of the territory of the Czech Republic, including the whole South Bohemia, the average annual benzene concentrations are below the lower assessment threshold (LAT).

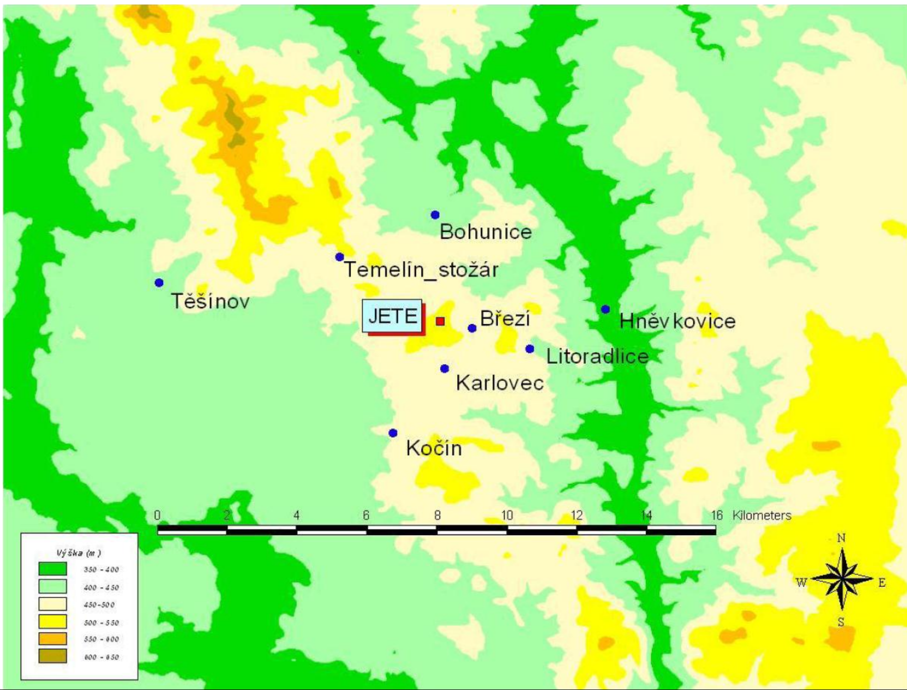
C.2.2.2. Climatic factors

C.2.2.2.1. Introductory data

The climatic, possibly meteorological characteristics of the area are monitored on the long-term scale and the data are collected by the Czech Hydrometeorological Institute which uses the extensive network of stations. As the data are very extensive, only the data related to the basic climatic characteristics of the Temelín location are presented in this documentation. The detailed data can be found in the Annexe to this documentation.

The presented data are based on the monitoring of the CHMI observatory Temelín (Temelín - tower) and the network of purpose-built stations in the neighbourhood of NPP Temelín. Their layout is shown in the following figure:

Figure C.2.15: CHMI observatory Temelín and the network of purpose-built stations in the NPP Temelín neighbourhood



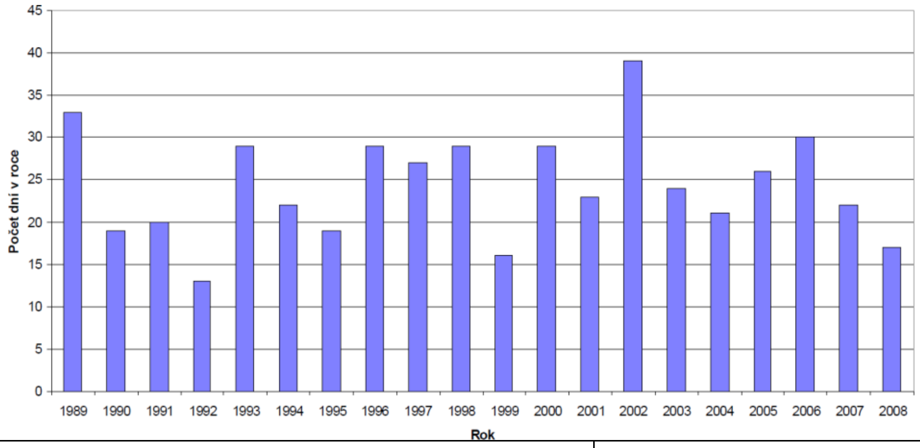
JETE	Temelín NPP
Temelín_stožár	Temelín_mast
Výška	Height

C.2.2.2.2. Climatic characteristics of the Temelín location

C.2.2.2.2.1. Significant weather phenomena

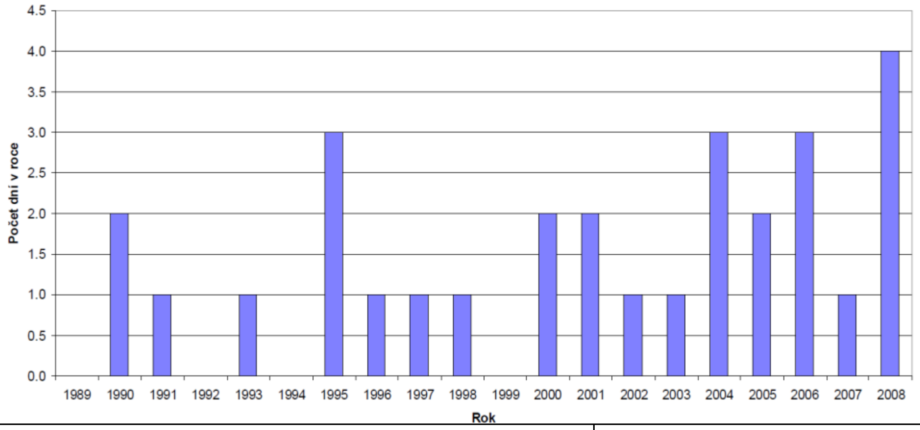
The following figures show the annual number of days with storm, hailstone, glaze, hoarfrost and with freezing precipitation.

Figure C.2.16: Annual number of days with storm



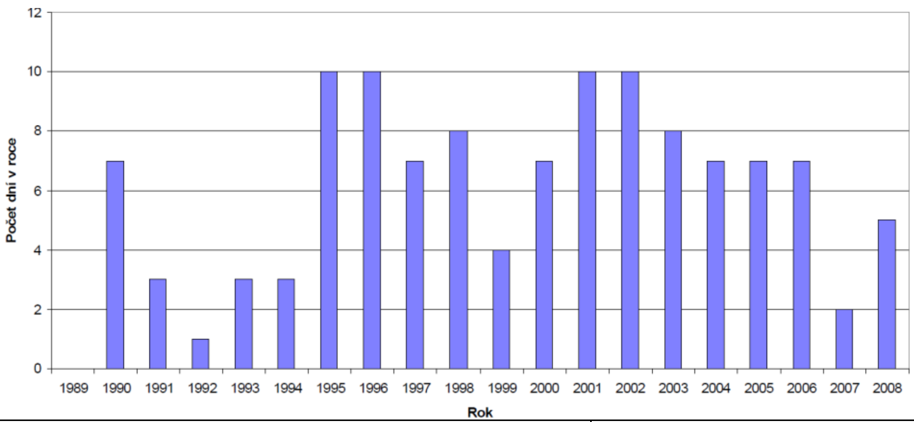
Počet dní v roce	Number of days in the year
Rok	Year

Figure C.2.17: Annual number of days with hailstone



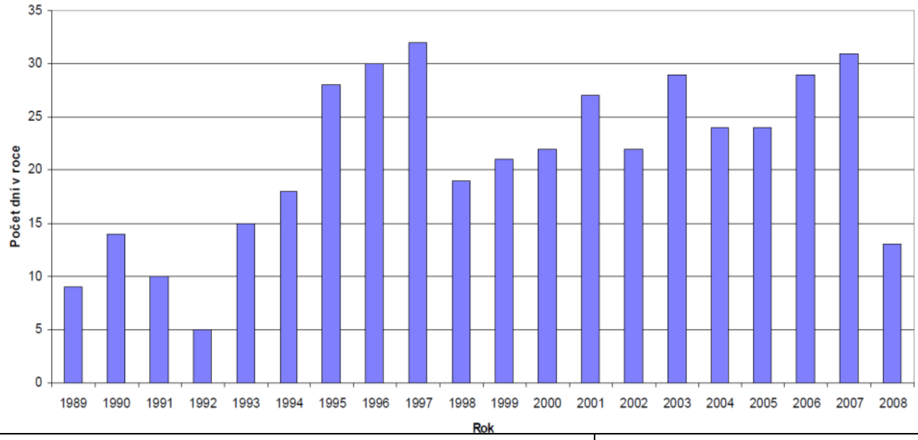
Počet dní v roce	Number of days in the year
Rok	Year

Figure C.2.18: Annual number of days with frost at Temelín station



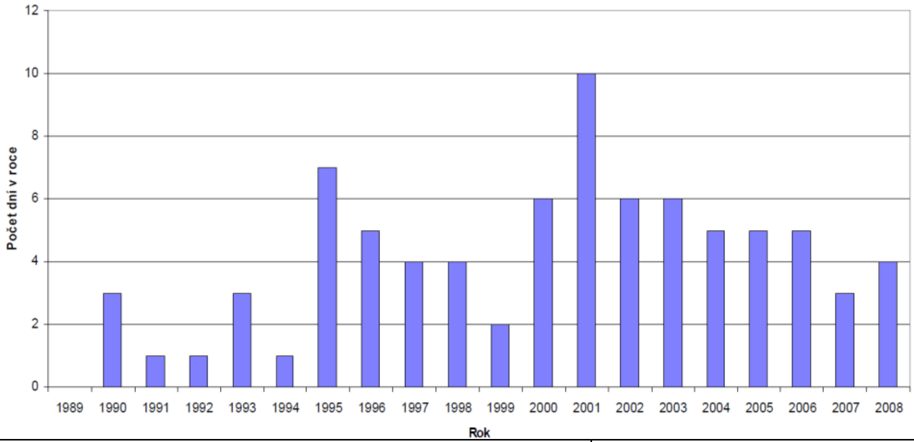
Počet dní v roce	Number of days in the year
Rok	Year

Figure C.2.19: Annual number of days with hoarfrost at Temelín station



Počet dní v roce	Number of days in the year
Rok	Year

Figure C.2.20: Annual number of days with freezing precipitation at Temelín station

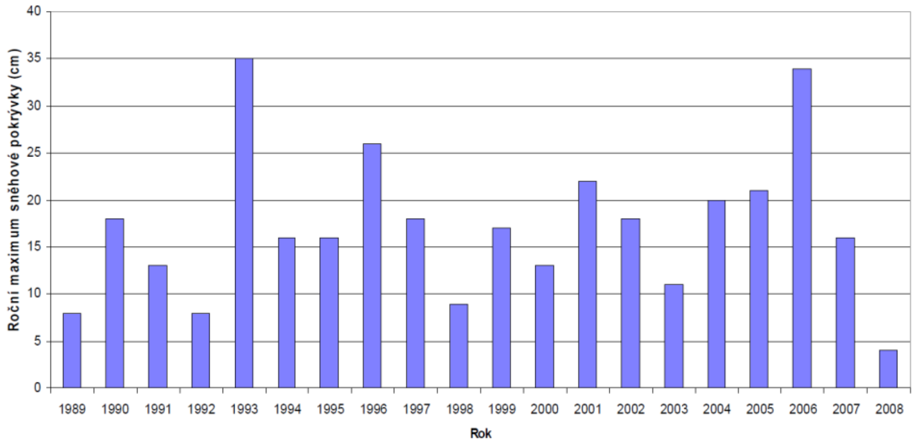


Počet dní v roce	Number of days in the year
Rok	Year

C.2.2.2.2.2. Snow cover

The following figure shows the annual maximums of snow cover at CHMI station Temelín.

Figure C.2.21: Annual maximum of snow cover at Temelín station



Roční maximum sněhové pokrývky	Annual maximum snow cover
Rok	Year

C.2.2.2.2.3. Precipitation

The following table shows the data regarding the monthly and annual precipitation totals at Temelín station.

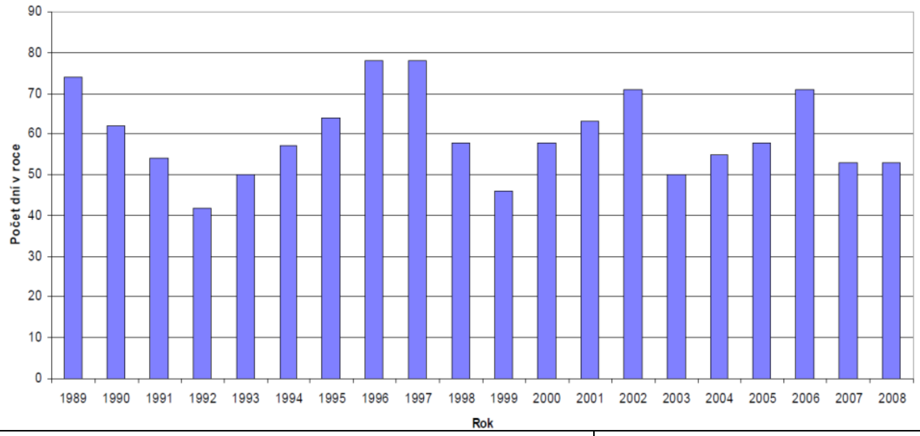
Table C.2.2: Monthly and annual precipitation totals [mm] at Temelín station

Year	Month												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
1989	6.0	16.9	12.8	49.8	32.3	88.2	91.3	75.3	67.6	22.9	29.3	18.4	510.8
1990	5.5	52.8	12.7	48.6	27.0	46.4	44.4	57.5	71.7	42.5	58.1	13.2	480.4
1991	7.1	6.9	33.2	17.2	59.8	96.8	114.4	32.8	23.2	7.3	52.0	35.4	486.1
1992	26.7	20.1	47.4	22.9	1.6	61.6	75.0	53.1	73.0	58.1	60.4	29.9	529.8
1993	30.5	21.4	7.9	12.8	66.9	109.5	100.2	32.5	89.2	53.6	42.7	54.9	622.1
1994	17.2	10.2	45.2	49.0	57.1	37.7	70.9	60.0	75.6	25.7	24.0	50.7	523.3
1995	32.9	17.7	34.8	35.3	138.1	88.4	34.5	102.5	71.7	8.3	37.3	28.2	629.7
1996	15.2	11.4	18.2	24.5	86.7	89.8	91.1	95.4	21.4	74.7	41.9	24.3	594.6
1997	3.1	18.4	52.9	70.1	28.5	77.1	130.7	69.6	18.2	34.7	37.1	35.2	575.6
1998	15.5	7.2	50.8	29.5	29.9	91.9	95.2	56.8	63.2	69.7	31.7	17.4	558.8
1999	22.2	36.5	17.6	30.6	59.5	37.0	75.7	38.9	39.1	10.6	24.1	26.9	418.7
2000	31.6	26.4	100.8	21.2	51.7	51.3	87.4	25.2	42.0	76.2	28.9	13.4	556.1
2001	29.0	10.4	60.1	71.6	67.6	94.9	134.3	99.4	54.3	22.4	36.1	39.2	719.3
2002	16.0	32.2	73.5	11.9	23.5	101.6	151.5	309.0	80.1	120.7	81.1	48.9	1,050.0
2003	37.5	4.6	10.7	9.4	116.3	78.5	45.4	21.7	15.2	82.6	18.8	34.3	475.0
2004	58.4	32.8	52.6	47.4	83.5	138.3	57.6	42.4	69.4	43.4	45.8	5.5	677.1
2005	32.4	39.1	12.0	41.3	83.5	57.6	177.3	106.3	101.6	6.7	19.9	28.7	706.4
2006	33.6	18.9	57.3	105.8	92.9	174.5	62.5	125.0	9.1	19.0	22.4	16.4	737.4
2007	37.6	24.3	35.7	4.7	86.1	62.0	48.9	66.0	132.7	49.6	37.1	18.0	602.7
2008	24.6	9.8	52.1	41.4	58.7	61.1	71.4	61.8	32.3	20.1	49.5	19.5	502.3
Minimum	3.1	4.6	7.9	4.7	1.6	37.0	34.5	21.7	9.1	6.7	18.8	5.5	418.7
Maximum	58.4	52.8	100.8	105.8	138.1	174.5	177.3	309.0	132.7	120.7	81.1	54.9	1,050.0
Average	24.1	20.9	39.4	37.3	62.6	82.2	88.0	76.6	57.5	42.4	38.9	27.9	597.8

C.2.2.2.2.4. Fog

The following figure shows the number of days with fog.

Figure C.2.22: Annual number of days with fog at Temelín station

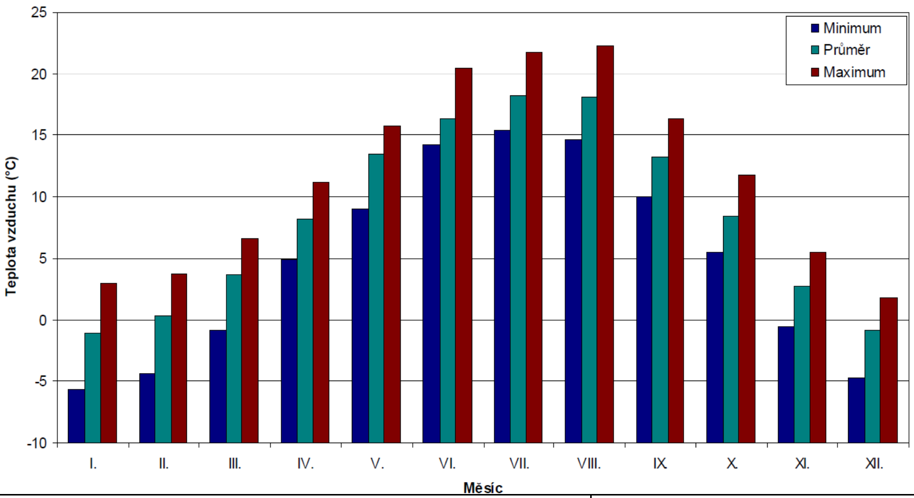


Počet dnů v roce	Number of days in year
Rok	Year

C.2.2.2.2.5. Temperature

The following figure shows the annual course of the average monthly temperature.

Figure C.2.23: Annual course of the average monthly temperature at Temelín station, 1989-2008

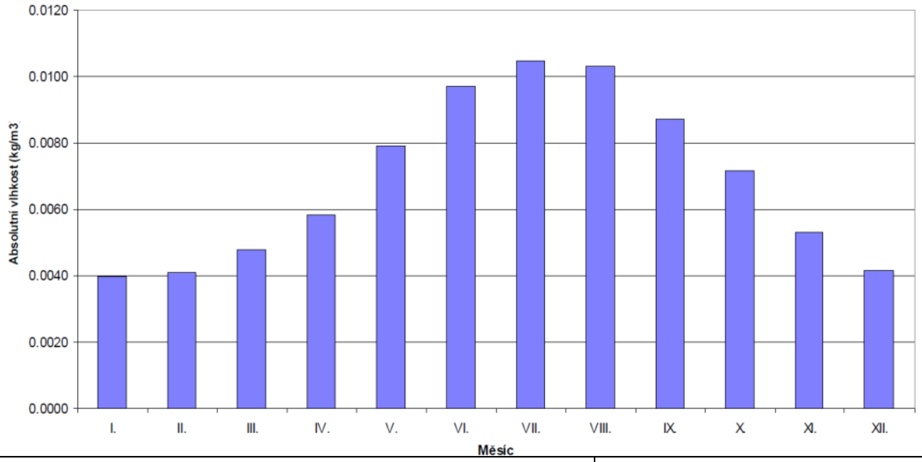


Teplota vzduchu	Air temperature
Měsíc	Month
Minimum	Minimum
Průměr	Average
Maximum	Maximum

C.2.2.2.2.6. Humidity

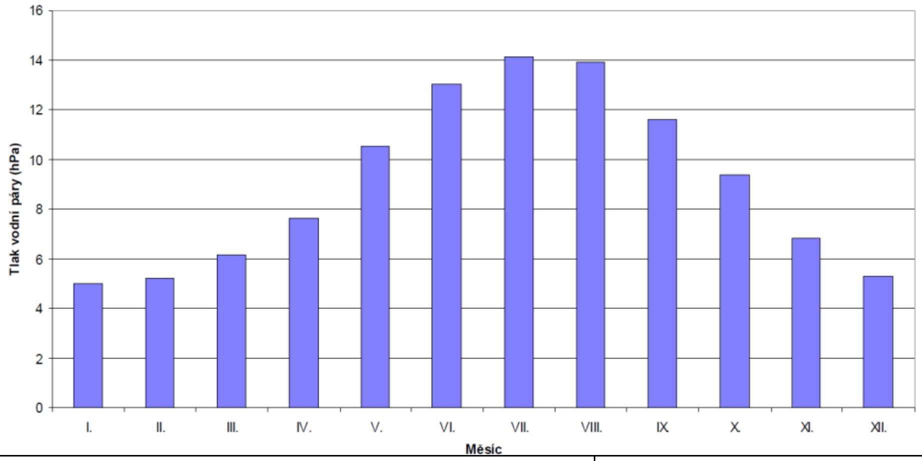
The following figures show the annual course of the absolute air humidity, vapour pressure, relative air humidity and dew point temperature (including air temperature).

Figure C.2.24: Annual course of the absolute air humidity [kg/m³] at Temelín station, 1989-2008



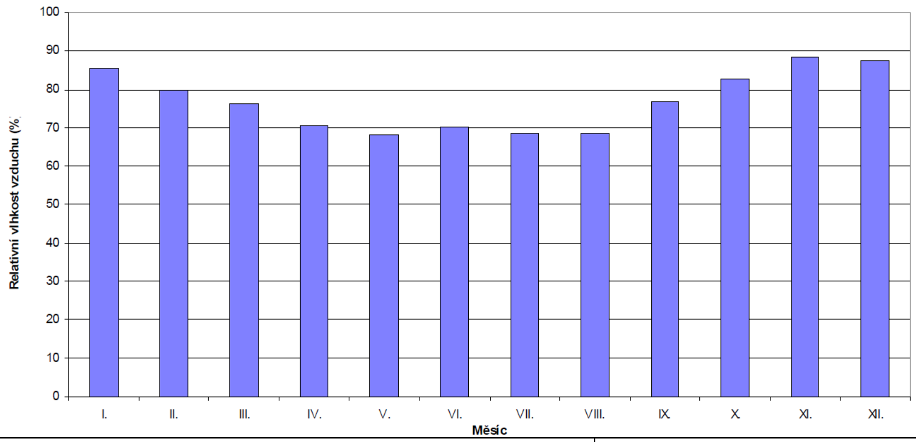
Absolutní vlhkost	Absolute humidity
Měsíc	Month

Figure C.2.25: Annual course of vapour pressure [hPa] at Temelín station, 1989-2008



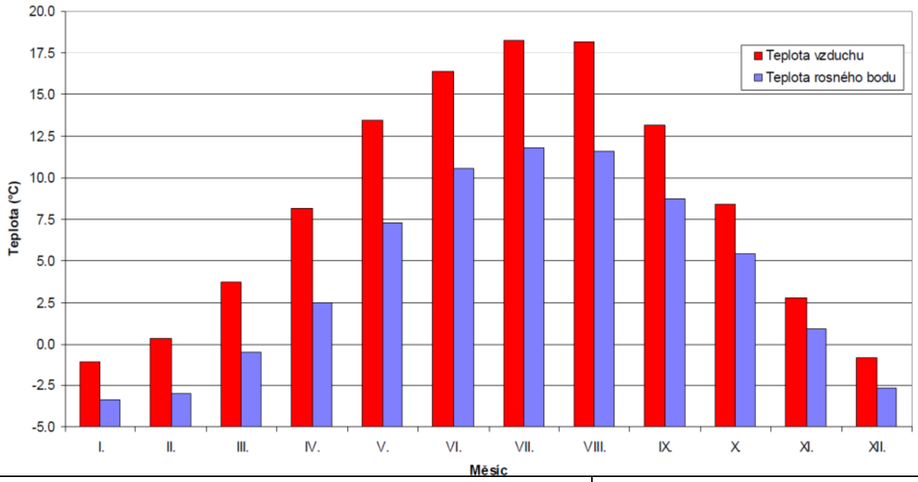
Tlak vodní páry	Water vapour pressure
Měsíc	Month

Figure C.2.26: Annual course of the relative air humidity [%] at Temelín station, 1989-2008



Relativní vhkost vzduchu	Relative humidity
Měsíc	Month

Figure C.2.27: Annual course of the average monthly air temperature and the dew point temperature [°C] at Temelín station, 1989-2008



Teplota	Temperature
Měsíc	Month
Teplota vzduchu	Air temperature
Teplota rosného bodu	Dew point

C.2.2.2.2.7. Wind

The following table shows the relative wind direction frequencies for individual wind speed classes.

Table C.2.3: Relative wind direction frequencies for each wind speed class at Temelín station, 1990-2008 [%]

Sector	Wind speed class [m/s]												Total
	0	1	2	3	4	5-6	7-8	9-12	13-16	17-20	21-25	> 25	
N	0	0.443	0.629	0.901	0.694	0.831	0.213	0.048	0.001	0	0	0	3.76
NNE	0	0.768	1.507	1.61	0.869	0.778	0.146	0.021	0.001	0	0	0	5.70
NE	0	0.87	2.168	2.016	0.941	0.625	0.108	0.009	0	0	0	0	6.74
ENE	0	0.753	1.428	1.268	0.619	0.485	0.094	0.013	0	0	0	0	4.66
E	0	0.637	1.122	1.304	0.861	0.947	0.336	0.1	0.004	0	0	0	5.31
ESE	0	0.524	0.821	1.209	1.014	1.55	0.658	0.251	0.012	0	0	0	6.04
SE	0	0.359	0.543	0.748	0.587	0.669	0.227	0.078	0.003	0	0	0	3.22
SSE	0	0.389	0.488	0.439	0.254	0.197	0.035	0.004	0	0.001	0	0	1.81
S	0	0.713	0.713	0.491	0.238	0.191	0.054	0.011	0.001	0	0	0	2.41
SSW	0	1.013	1.657	0.983	0.451	0.399	0.115	0.025	0.003	0	0	0	4.65
SW	0	1.616	3.223	2.241	1.043	1.12	0.51	0.213	0.024	0.001	0	0	9.99
WSW	0	1.106	2.198	1.828	1.191	1.86	1.091	0.716	0.101	0.005	0.001	0	10.10
W	0	0.633	1.132	1.659	1.607	3.13	1.958	1.031	0.113	0.006	0.001	0	11.27
WNW	0	0.399	0.697	1.028	1.193	2.455	1.366	0.578	0.049	0.003	0	0	7.77
NW	0	0.299	0.633	0.844	0.657	0.825	0.358	0.091	0.009	0.001	0	0	3.72
NNW	0	0.288	0.541	0.809	0.608	0.721	0.227	0.056	0.002	0	0	0	3.25
calm	3.42	0	0	0	0	0	0	0	0	0	0	0	3.42
variable	0	3.263	2.797	0.131	0.002	0	0	0	0	0	0	0	6.19
total	3.42	14.071	22.295	19.511	12.828	16.784	7.497	3.247	0.324	0.017	0.002	0	100.00

C.2.2.2.2.8. Sunshine

The following table shows the duration of sunshine in individual months of the year for the period of 1989 to 2008 as well as the average, minimum and maximum.

Table C.2.4: Sunshine duration at Temelín station [hr]

Year	Month												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
1989	85.9	54.1	155.4	137.6	246.1	207.4	223.3	207.7	157.4	167.0	79.1	66.4	1,787.4

1990	71.5	141.6	166.3	162.5	296.8	221.6	274.9	256.5	136.4	174.3	32.7	57.1	1,992.2
1991	93.8	122.8	82.9	168.1	162.2	232.5	282.3	245.7	176.2	156.4	39.1	54.1	1,816.1
1992	62.3	96.8	127.8	157.3	306.3	191.0	268.0	291.7	190.9	88.5	47.9	41.8	1,870.3
1993	94.1	105.8	142.4	189.7	278.4	217.2	226.2	275.3	179.8	88.9	33.5	40.0	1,871.3
1994	54.8	88.4	109.4	167.8	212.0	248.0	310.1	268.7	137.3	135.5	39.5	62.9	1,834.4
1995	48.2	78.6	139.6	126.6	247.7	156.5	299.9	204.7	146.7	134.9	38.3	24.5	1,646.2
1996	28.8	98.9	102.7	167.1	172.7	256.7	234.1	198.0	81.0	89.9	68.5	57.9	1,556.3
1997	39.6	111.1	117.0	174.9	257.9	247.3	202.8	278.0	249.8	151.6	62.6	27.1	1,919.7
1998	93.8	121.9	148.7	160.2	254.7	240.7	193.4	285.1	108.0	85.8	59.4	67.6	1,819.3
1999	53.1	54.5	124.0	182.8	225.1	186.9	273.5	224.4	193.7	121.0	79.6	71.0	1,789.6
2000	64.2	96.6	93.8	195.3	274.7	317.3	158.7	273.9	167.4	87.0	81.0	36.9	1,846.8
2001	60.2	106.6	90.5	170.0	292.2	216.1	243.3	244.4	78.8	130.5	67.8	41.4	1,741.8
2002	76.5	96.2	166.3	173.2	254.6	300.9	247.7	209.1	166.1	96.0	43.0	31.7	1,861.3
2003	50.4	123.7	172.7	232.7	244.3	320.4	248.8	317.5	227.1	99.0	66.6	52.3	2,155.5
2004	57.2	66.6	147.7	206.9	217.9	211.6	235.2	254.7	205.8	132.4	38.5	43.5	1,818.0
2005	68.5	70.5	160.4	205.2	276.3	268.1	217.9	187.7	187.0	161.6	32.6	41.1	1,876.9
2006	68.2	77.4	92.6	151.0	216.6	233.3	328.0	139.7	239.7	143.0	58.1	71.9	1,819.5
2007	47.6	88.6	158.7	307.0	253.6	253.8	239.3	234.6	142.4	105.7	42.3	40.8	1,914.4
2008	52.9	137.0	127.1	151.8	218.4	208.6	214.6	242.8	134.0	127.3	70.2	47.8	1,732.5
Average	63.6	96.9	131.3	179.4	245.4	236.8	246.1	242.0	165.3	123.8	54.0	48.9	1,833.5
Minimum	28.8	54.1	82.9	126.6	162.2	156.5	158.7	139.7	78.8	85.8	32.6	24.5	1,556.3
Maximum	94.1	141.6	172.7	307.0	306.3	320.4	328.0	317.5	249.8	174.3	81.0	71.9	2,155.5

C.2.2.2.2.9. Visibility,

The following table shows the average visibility for individual months and the annual total from 1990 to 2007.

Table C.2.5: Average hours and days for each visibility class at Temelín station, 1990-2007

Month	Visibility 0-1 km		Visibility 1-5 km		Visibility 5-10 km		Visibility 10 km and more	
	Hours	days	hours	days	hours	days	hours	days
1	64	9	178	18	95	16	407	23
2	28	5	93	14	95	17	461	26
3	22	6	97	15	93	19	532	29
4	9	3	40	9	61	14	610	29
5	8	3	23	6	36	10	677	31
6	7	3	23	6	36	10	655	30
7	8	3	16	6	26	9	695	31
8	10	3	31	8	40	11	663	31
9	25	7	37	10	51	14	607	30
10	65	11	94	16	85	19	500	28
11	90	12	137	19	94	19	400	25
12	69	10	160	19	126	20	390	24
Year (total)	404	74	928	145	837	177	6596	336

C.2.3. Noise and other physical and biological characteristics

C.2.3.1. Noise

The Temelín Nuclear Power Plant is located in South Bohemia near the village of Temelín. The nearest residential development in the neighbourhood of the Temelín Nuclear Power Plant and Kočín switchyard is located in the villages of Litoradlice, former village of Knín, Kočín, Malešice, Sedlec and Temelín. A larger residential conurbation is located at an approximate distance of 5 km in the town of Týn nad Vltavou. The wider area around the Temelín Nuclear Power Plant is defined by the road network, where the road transport related to the power plant is operated and it forms “significantly affected roads”. The noise from rail transport at the Číčenice - Týn nad Vltavou track and the power plant siding are independent sources.

C.2.3.1.1. Noise from the Temelín Nuclear Power Plant

The existing operation and the premises of the Temelín Nuclear Power Plant can be divided to several operational parts. The first of them is the so called "production part", which includes the technology directly related to the electric power generation. It is the reactor part together with the power house, switchyard and heat-exchanger station. Two reactor blocks are located on the premises; each block has its "production part", other plants are common. The second operational part includes the plants with cooling technology, i.e. mainly 4 cooling towers (two per reactor block), cooling water pumping station, spraying basins, cooling water treatment plant, water chemical treatment plant and water reservoir. The third operational part includes the service and additional plants for the "production part", which is mainly the building of main active auxiliary plants, spend nuclear fuel storage facility, diesel-generator, compressor and pumping stations, heat evacuation power house and waste water treatment plant. Other buildings on the premises are of the technical and administrative background nature. They mainly include workshops, storage houses, operations and administrative buildings.

The Temelín Nuclear Power Plant operations also include the Kočín switchyard, which, however, is the property of CEPS. The switchyard is used to evacuate the power plant's power to the power distribution grid. The switchyard includes 2 oil transformers with the capacity of 250 MVA.

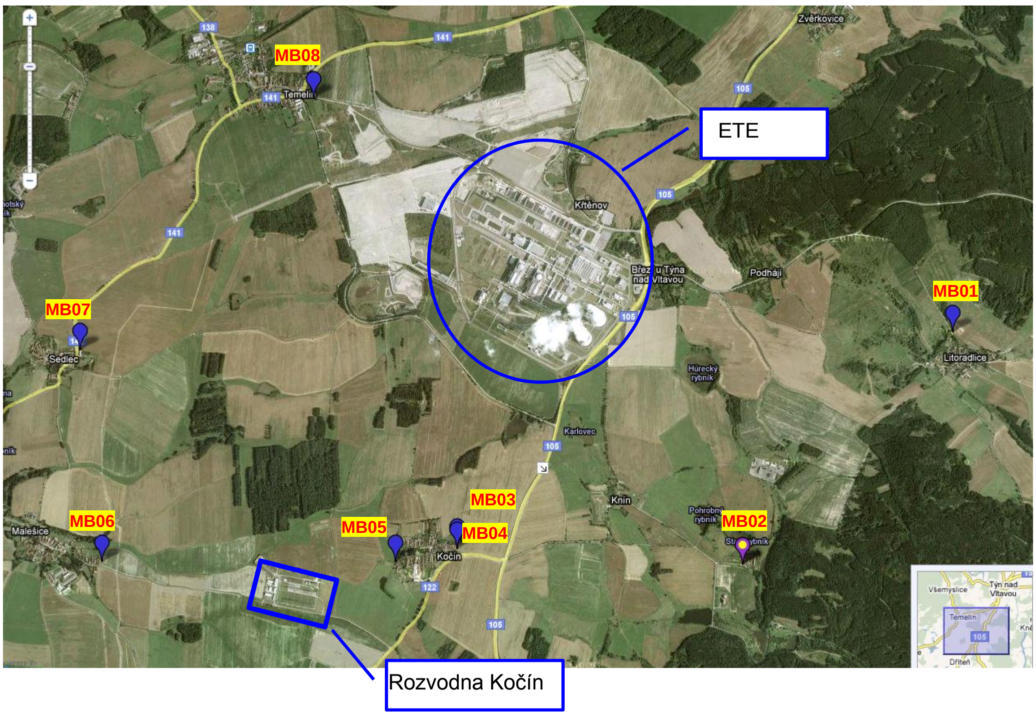
The operation of the Temelín Nuclear Power Plant and the Kočín switchyard is continuous, identical during both the day and night.

All the data regarding the existing state are considered for the maximum operating capacity, i.e. also for the maximum concourse of the technological equipment on the power plant's premises.

In order to set the noise background, the noise measurement at the nearest housing development regarding the nuclear power plant Temelín was performed. The measurement was carried out during the maximum capacity of both power plant blocks and the Kočín switchyard.

The list of measurement points is specified in the following figure and the following table.

Figure C.2.28: Marking of measurement points



ETE	Temelín PP
Rozvodna Kočín	Kočín switchyard

Table C.2.6: Overview of measurement points - operation

Point of measurement	Description	Microphone height	Distance from the source of noise
MB01	Litoradice boundary - point from which the NPP is directly visible	3 m	2,500 m
MB02	Former homestead behind the former village of Knín	3 m	2,000 m
MB03	Northeastern boundary of Kočín	3 m	1,500 m
MB04	Northeastern boundary of Kočín – point where noise from the switchyard can be heard	3 m	1,550 m from NPP Temelín, 950 m from the switchyard
MB05	Southwestern boundary of Kočín - point impacted by noise from the switchyard	3 m	1,800 m from NPP Temelín, 480 m from the switchyard
MB06	Malešice boundary	3 m	3,400 m from NPP Temelín, 1,200 m from the switchyard
MB07	Sedlec boundary	3 m	2,900 m
MB08	Temelín boundary	3 m	1,300 m

The selected measurement points MB01 - MB08 are the most exposed in terms of the protection against the unfavourable impacts of noise and vibrations. For the other measurement points the lower noise load is expected.

The following table shows the results of the measurement between 10 March 2009 and 25 March 2009.

Table C.2.7: Noise measurement results

Point of measurement	Measured value [dB]				Resulting value [dB]	Tone component	Complies with the limit
	10/03	11/03	12/03	25/03			
	$L_{Aeq,T}$	$L_{Aeq,T}$	$L_{Aeq,T}$	$L_{Aeq,T}$	$L_{Aeq,T} \pm U_{AB}$		
MB01	31.7	35.2	35.7	33.3	33.9 ± 5	no	yes
MB02	34.2	36.2	35.3	32.0	34.4 ± 5	no	yes
MB03	33.6	37.8	33.9	32.2	34.4 ± 5	no	yes
MB04	32.5	38.4	35.5	35.1	35.5 ± 5	no	yes
MB05	35.3	34.6	38.6	36.5	36.2 ± 5	yes	no
MB06	25.9	24.5	27.7	23.7	25.5 ± 5	no	yes
MB07	-	33.0	34.2	28.8	32.0 ± 5	no	yes
MB08	31.3	35.2	37.2	33.2	34.2 ± 5	no	yes

Note: The resulting value is set as an average of the measured values on individual days.

It follows from the results of the measurement that during the daytime the equivalent level of acoustic pressure from the operation of the NPP Temelín premises and Kočín switchyard including the measurement uncertainty is lower than the limit value for the daytime. The compliance with the outdoor hygienic noise limit for daytime as specified by Government Decree no. 148/2006 Coll., on health protection from the adverse effects of noise and vibrations, is provable.

During the night time, the equivalent level of acoustic pressure from the operation of the NPP Temelín premises and Kočín switchyard, including the measurement uncertainty, is lower than the limit value for the night time, specifically at points MB01, MB02, MB03, MB06, MB07 and MB08. The compliance with the outdoor hygienic noise limit for night time as specified by Government Decree no. 148/2006 Coll., on health protection from the adverse effects of noise and vibrations, is provable.

The equivalent level of acoustic pressure from the operation of the NPP Temelín premises and Kočín switchyard at point MB04 is lower than the limit value for the night time. Since the limit value occurs in the range of uncertainty of the measurement, the exceeding of the outdoor hygienic noise limit as specified by Government Decree no. 148/2006 Coll., on health protection from the adverse effects of noise and vibrations, is not provable.

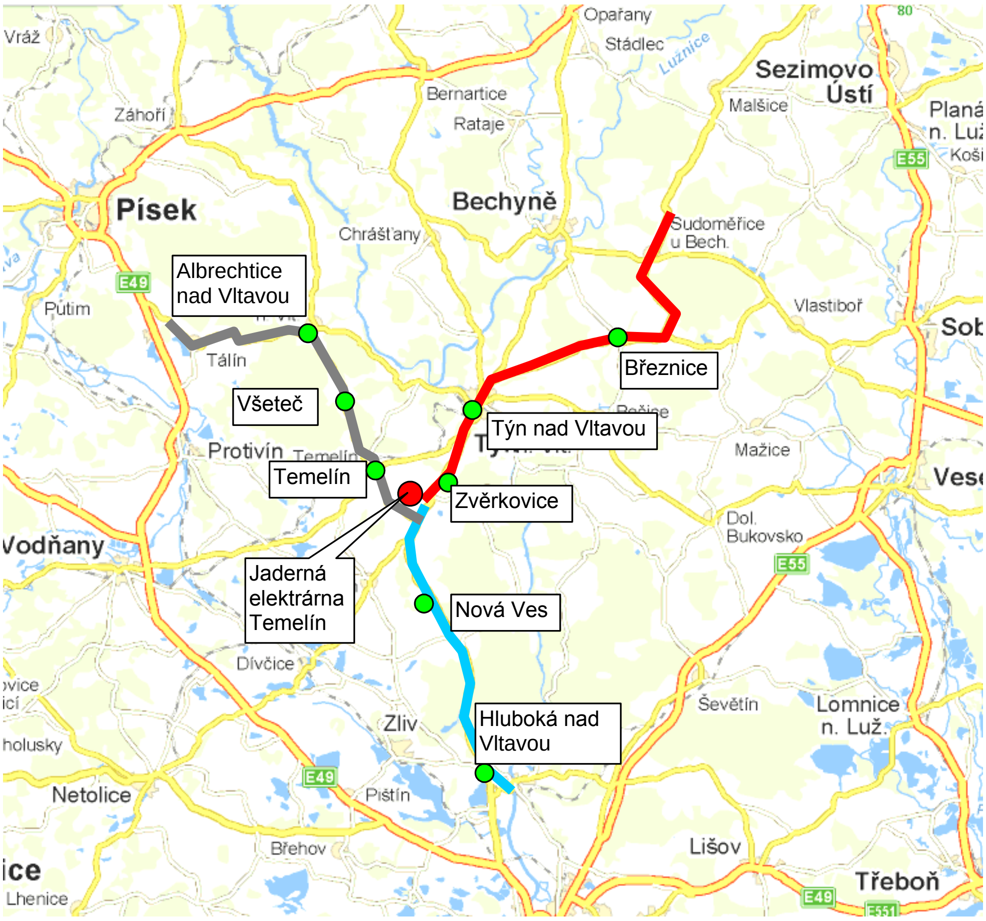
As a result of the presence of tone component from the operation of the Kočín switchyard, the equivalent level of acoustic pressure from the operation of the NPP Temelín premises and Kočín switchyard is higher than the limit value for night time, specifically at point MB05 (noise from the switchyard operation). Since the limit value occurs in the range of uncertainty of the measurement, the exceeding of the outdoor hygienic noise limit as specified by Government Decree no. 148/2006 Coll., on health protection from the adverse effects of noise and vibrations, is not provable.

The Temelín Power Plant operation also includes non-standard operations, e.g. operation of steam-generator pressure relief valves, relief station to the atmosphere and reduction station pressure relief valves. For the existing state, the measurement of the impact of the relief station blow-off to the atmosphere (steam blow-off) was carried out, as the noisiest among the above-specified sources, at the nearest, possibly the most affected protected outside area (point MB03 - northeastern boundary of Kočín and MB08 Temelín boundary). The measurement was carried out during the planned shutdown of unit 2. During the normal operation, the opening of the relief station to the atmosphere does not occur; it may only occur in the case of abnormal operation, upon emergency conditions and their testing. The blow-off tests are performed once a year, only during the daytime and always for the minimum necessary duration of several seconds. The results of measurement show that during the 8 continuous and subsequent noisiest hours, the noise level in the measurement points reaches up to $L_{Aeq,T}$ = 56.1 ± 5 dB (point MB03), or $L_{Aeq,T}$ = 56.6 ± 5 dB (point MB08) respectively.

C.2.3.1.2. Noise from motor transport

At present, the motor transport is the significant source of noise in the location. The following figures show the diagram of significantly affected roads.

Figure C.2.29: Marking of individual municipalities, access and exit routes related to the common power plant operation



Jaderná elektrárna Temelín	Temelín Nuclear Power Plant

The inspection points were chosen for each municipality in order to cover the nearest, possibly the most affected noise-protected outdoor area in contact with the through roads. In Albrechtice nad Vltavou they include 5 inspection points, in Březnice 3 inspection points, in Hluboká nad Vltavou 3 inspection points, in Nová Ves 3 inspection points, in the village of Temelín 7 inspection points, in Týn nad Vltavou 6 inspection points, in Všeteč 3 inspection points and in Zvěrkovice 2 inspection points. The overview of inspection points is given in the table below.

Table C.2.8: Overview of inspection points

Municipality	Name of calculation points
Albrechtice nad Vltavou	ALBR 1, ALBR 2, ALBR 3, ALBR 4, ALBR 5
Březnice	BREZ 1, BREZ 2, BREZ 3
Hluboká nad Vltavou	HLUB 1, HLUB 2
Nová Ves	NVES 1
Temelín	TEM1, TEM 2, TEM 3, TEM 4, TEM 5, TEM 6, TEM 7
Týn nad Vltavou	TYN 1, TYN 2. TYN 3, TYN 4, TYN 5, TYN 6
Všeteč	VSET 1, VSET 2, VSET 3
Zvěrkovice	ZVER 1, ZVER 2

The results are given in the table below.

Table C.2.9: Results of noise calculation around significantly affected roads

Point	Floor	Background in 2005 [dB(A)]	
		Daytime	Night time
ALBR 1	1	59.1	52.1
	2	59.1	52.1
ALBR 2	1	64.0	56.8
	2	63.9	56.7
ALBR 3	1	66.7	59.6
	2	66.4	59.3
ALBR 4	1	65.9	58.9
	2	65.6	58.5
ALBR 5	1	66.5	59.5
	2	66.0	58.9
BREZ 1	1	65.3	58.2
	2	66.2	59.0
BREZ 2	1	68.4	61.3
	2	68.3	61.1
BREZ 3	1	70.1	63.0
	2	69.4	62.3
HLUB 1	1	69.1	62.1
	2	69.2	62.1
HLUB 2	1	63.6	56.5
	2	65.1	58.0
NVES 1	1	60.3	53.0
	2	60.3	53.0
TEM 1	1	58.6	51.0
	2	58.2	50.7
TEM 2	1	61.5	54.5
	2	61.5	54.5
TEM 3	1	62.6	56.9
	2	62.5	56.8
TEM 4	1	63.0	57.2
	2	62.8	57.0
TEM 5	1	63.8	57.5
	2	64.1	57.9
TEM 6	1	56.4	49.8
	2	56.5	50.0
TEM 7	1	59.4	52.8
	2	59.3	52.7
TYN 1	1	63.8	56.5
	2	64.0	56.8
TYN 2	1	58.1	50.8
	2	58.1	50.9
	3	58.2	51.0
	4	58.3	51.1
	5	58.5	51.2
	6	58.6	51.4
TYN 3	1	60.8	53.6
	2	60.8	53.6
	3	60.8	53.6
	4	60.8	53.6
	5	60.7	53.5
	6	60.7	53.4
TYN 4	1	62.8	55.7
	2	62.9	55.8

TYN 5	1	59.9	52.7
	2	60.1	53.0
TYN 6	1	59.8	52.7
	2	61.4	54.3
VSET 1	1	53.2	46.6
	2	52.6	46.0
VSET 2	1	58.3	51.8
	2	59.0	52.4
VSET 3	1	56.1	49.1
	2	56.1	49.1
ZVER 1	1	61.3	54.0
	2	61.5	54.2
ZVER 2	1	65.3	58.0
	2	65.3	58.0

Note: The figures in red exceed the basic health limits for noise from major roads and streets (Government Decree no. 148/2006 on health protection from adverse impacts of noise and vibrations).

It is obvious from the calculated results at individual inspection points that the exceeding of the basic hygienic noise limit $L_{Aeq,T}$ = 60/50 dB (daytime/night time), applicable for the noise from major roads and streets, has been established practically for all affected municipalities (calculation points). The limit adjusted for the so called old noise burden (i.e. the burden historically formed) $L_{Aeq,T}$ = 70/60 dB (daytime/night time) is observed in the majority of inspection points.

Noise from rail transport on track no.192, Číčenice - Týn nad Vltavou, including the Temelín NPP siding, does not increase the noise level in the village of Temelín to above the daytime and night time regulatory limits.

C.2.3.2. Vibrations

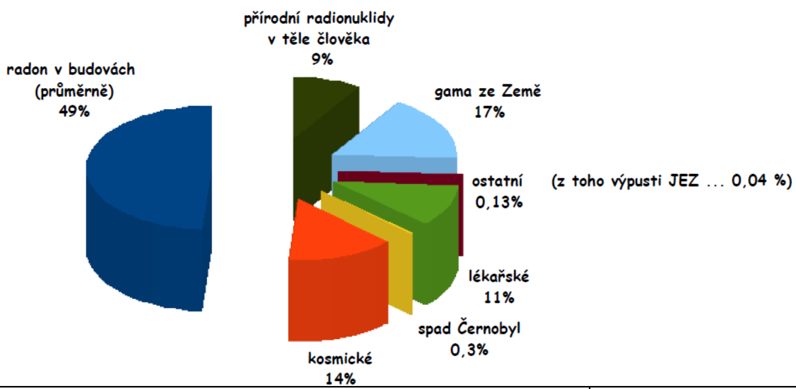
The analyses, as well as measurements performed during the operation of the Temelín Nuclear Power Plant proved that during its operation the power plant does not cause any vibrations that might affect its neighbourhood. Requirements of all regulations for health protection from vibrations are safely complied with.

C.2.3.3. Ionising radiation

C.2.3.3.1. Overview and population dose distribution for the Czech Republic

Natural irradiation has the most significant share in irradiation of the population. Dominant population doses from the natural radiation result from inhaling of the products of radon decay in buildings; in other places there is a dose from external gamma irradiation from natural radionuclides present in the building materials and in the Earth, a dose from cosmic radiation and doses from internal irradiation mainly from isotope ^{40}K and other natural radionuclides as a result of ingestion. According to the present knowledge, they represent more than 80% of the average population irradiation in our conditions. The population dose distribution is obvious from the following figure:

Figure C.2.30: Estimate of population dose distribution in the Czech Republic in the past



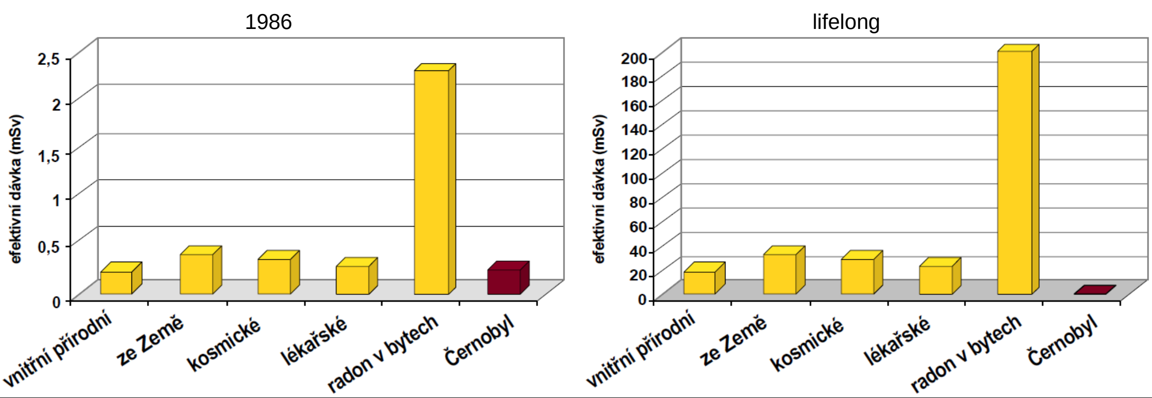
Radon v budovách (průměrně)	Radon in buildings (average)

Přírodní radionuklidy v těle člověka	Natural radionuclides in human body
Gama ze Země	Gamma from Earth
Ostatní (z toho výpustí JEZ ...)	Other
Lékařské	Medical
Spad Černobyl	Chernobyl fallout
Kosmické	Cosmic

The total average population dose is estimated to approximately 3.7 mSv a year. The most significant share of the exposure, radon inhaling in buildings, varies in time; new estimates in the Czech Republic already indicate an equivalent over 50%. So far the equivalent of the so called medical irradiation in the Czech Republic was estimated at approximately 11 percent. It is this component of the population irradiation which presently increases the fastest, especially as a result of expansion of CT diagnostics and examination using nuclear medicine. It can be expected that the growth will be similar to the USA or western Europe so soon the medical irradiation doses will probably be comparable to the irradiation from radon and other natural radionuclides.

Other equivalents to the irradiation of the population include irradiation resulting from nuclear power plant operation, use of radionuclides in industry and research, possibly the residua after nuclear weapon testing. This equivalent is absolutely minor with respect to the above-specified doses. The average annual effective dose to the population of the Czech Republic as a result of the Chernobyl nuclear Power Plant accident in 1986 was approximately 0.2 mSv, which represented approximately 6% of the average annual population dose as a result of the exposure to radon and other natural radionuclides. In terms of the lifelong dose it can be estimated based on simulations that the life-long average effective dose for an inhabitant of the Czech Republic, as a result of an accident, represents approximately the equivalent of 0.2% to the average lifelong effective dose from all sources of irradiation.

Figure C.2.31: Comparison of the average annual (1986) and the lifelong effective dose of an inhabitant of the Czech Republic as a result of the Chernobyl nuclear Power Plant accident with other irradiation sources



Efektivní dávka	Effective dose
Vnitřní přírodní	Internal natural
Kosmické	Cosmic
Ze Země	From Earth
Lékařské	Medical
Radon v bytech	Radon in homes
Černobyl	Chernobyl
Observatoře (ČHMÚ)	Observatories (Czech Hydrometeorological Institute - CHI)
AIM ČHMÚ	CHI's Automatic Air Quality Monitoring stations
RC SÚJB	State Nuclear Safety Board Regional Centre
Pracoviště HZS	Main rescue station
Armáda ČR	Czech Army

C.2.3.3.2. Radiation situation monitoring

This chapter summarises the results of monitoring and their evaluation. The monitoring is performed by independent bodies as well as the power plant operator. Thus the data are divided into three groups.

- territorial monitoring,
- monitoring performed by the NPP Temelín operator,
- independent monitoring of the Temelín plant.

The scope of monitoring is based on the requirements of the Czech legal regulations (Decree no. 319/2002 Coll.), which were used in the terms for the permit to operate the NPP Temelín issued by the SÚJB and in the approved documentation (mainly the monitoring programmes and internal emergency plan), as well as on the EU directives and recommendations.

C.2.3.3.2.1. Territorial monitoring

This chapter summarises the results of independent territorial monitoring, while Chapter C.2.3.3.2.3. summarises the results of local independent monitoring with the comparison of these results to the measurements performed by the operator. In compliance with the above-mentioned decree, the data are presented in the following areas:

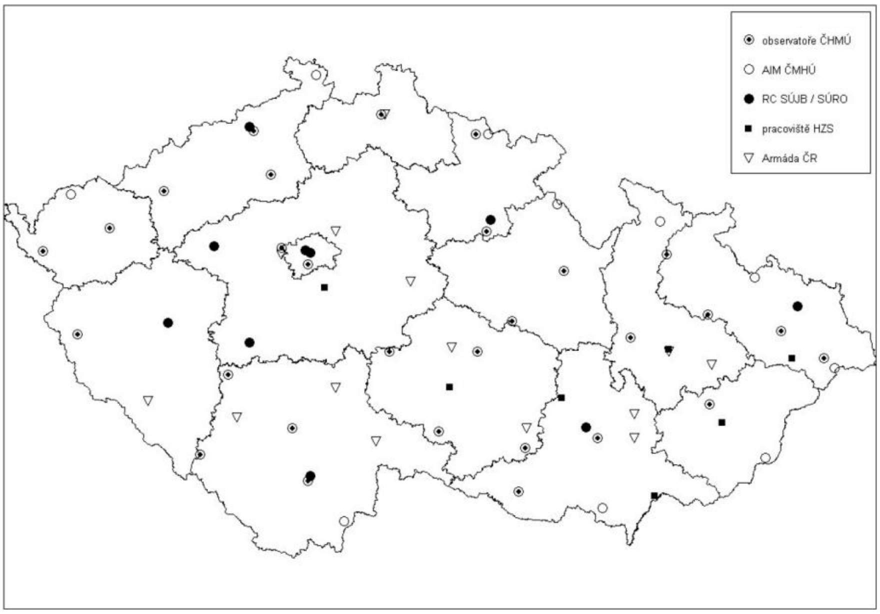
- monitoring of external irradiation,
- monitoring of the environment,
- food chain monitoring,
- monitoring of people.

Monitoring of external irradiation

Monitoring of external irradiation is provided by: territorial early warning network (EWN) and teledosimetric systems (TDS) around our nuclear power plants, as well as territorial and local TLD networks and mobile and aerial RMN groups[1].

The distribution of the monitoring points of the early warning network (EWN) in the territory of the Czech Republic is shown in the following figure:

Figure C.2.32: Early warning network of RMN of the Czech Republic (2008)

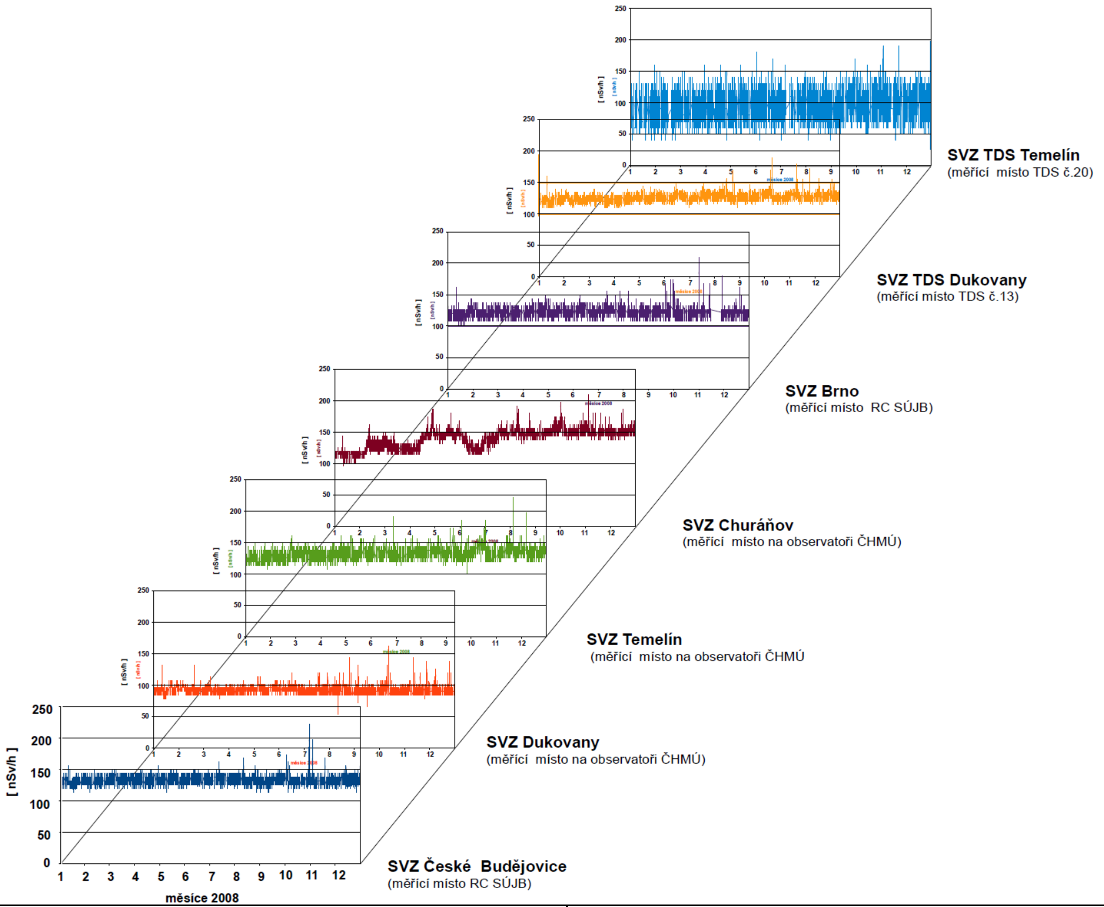


The early warning network has been gradually implemented to the present form since the beginning of the 1990s. The EWN monitoring points are equipped with a pair of probes providing continuous measurement of the photon dose equivalent input (PDEI) (average 10-minute values of the input) in the range of $5x10^{-8}$ to

[1] The monitoring performed by mobile ground and aerial groups is not directly related to the subject of the documentation and therefore it is not further mentioned.

1 Sv/hour. The obtained values are delivered to the central board in SÚRO/SÚJB in regular intervals. From 9 EWN stations located in the air pollution monitoring points (APMP) at RC SÚJB and SÚRO and from 7 stations situated at fire brigade boards, the monitored values are provided each 10 minutes. From 38 monitoring points situated in CHMI observatories, the data are sent to the central board via the CHMI server every hour. This interval can be shortened to 30 minutes in the case of a radiation emergency. In the neighbourhood of the Dukovany and Temelín nuclear power plants the EWN is completed with a teledosimetric system (TDS), which consists of 24 detectors in the neighbourhood of NPP Temelín and 27 detectors in the neighbourhood of NPP Dukovany. The Czech Army provides monitoring of the photon dose equivalent input using one-shot measurement in another 16 places, specifically twice a day (the Czech Army has started the process of gradual transformation to the online monitoring system). The updated data from EWN are processed centrally and published at the SÚRO website (www.suro.cz). By way of illustration, the following figure shows the results of the all-year monitoring of the average values of PDEI at five EWN locations (České Budějovice, Dukovany, Temelín, Churáňov and Brno) and from the NPP Dukovany TDS and NPP Temelín TDS.

Figure C.2.33: The photon dose equivalent input for the selected monitoring points [nSv/h], 2008

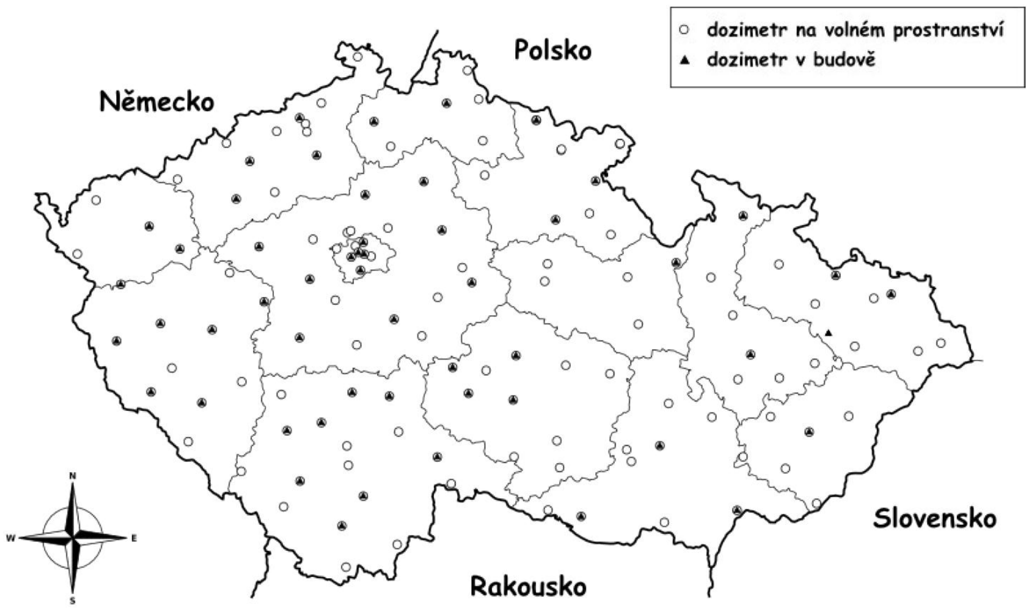


měřicí místo	monitoring point

During the above-mentioned period, the intervention level of 500 nSv/hour, which would be caused by a radiation situation change in the monitoring point, was not exceeded at the EWN stations.

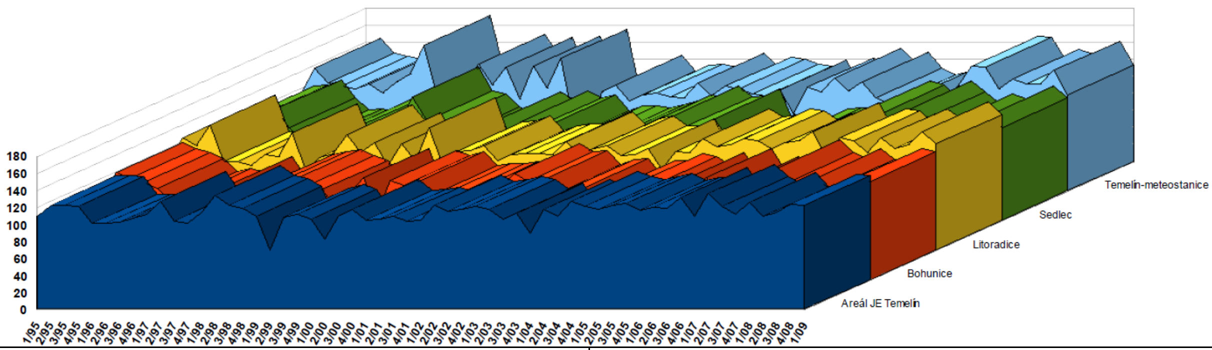
Other systems that have been used since the end of the 1980s for blanket monitoring of external irradiation dose equivalent include the networks of thermoluminescence dosimeters (TLD) distributed more or less evenly in the territory of the Czech Republic (territorial TLD network) and with higher density in the neighbourhood of NPP Dukovany and NPP Temelín (local TLD networks). The networks consist of a total 206 monitoring points, out of which 9 locations are in the local network of NPP Temelín and 12 in the local network of NPP Dukovany. In addition to the TLD state-operated networks, the TLD networks operated by the operator are used in the neighbourhood of NPPs (there are 36 dosimeters in the NPP Dukovany neighbourhood and 35 dosimeters in the NPP Temelín neighbourhood). The dosimeters are located 1 metre above the ground (in the local EDU network operated by LRKO at 3 m). One third of the dosimeters from the territorial TLD network are located in buildings in order to provide an opportunity to assess the efficiency of sheltering inhabitants in the case of a radiation accident. The monitoring is performed using the integral 3-month measurement, in the case of a radiation accident, the interval would be shortened as needed (depending on the scope and course of the accident). The distribution of the TLD network monitoring points in the territory of the Czech Republic is shown in the following figure:

Figure C.2.34: Territorial TLD network



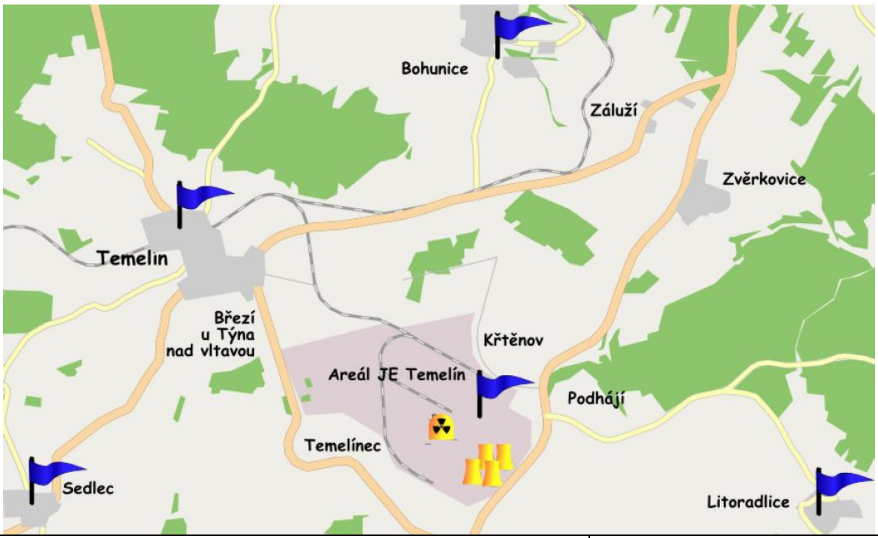
The following figure shows the long-term time changes of PDEI at the selected points of TLD networks in the neighbourhood of the NPP Temelín. The next map shows the location of the points.

Figure C.2.35: The time distribution of the photon dose equivalent input (quarterly averages), 1995-2008, obtained using the TLD network monitoring points in the NPP Temelín neighbourhood [nSv/hour]



Areál JE Temelín	Temelín NPP complex
Temelím meteostanice	Temelín meteo station

Figure C.2.36: Location of selected TLD monitoring points in the NPP Temelín neighbourhood



Areál JE Temelín	Temelín NPP complex

Average quarterly photon dose equivalent input values in selected monitoring points in the TLD territorial network in 2008 are shown in the following table.

Table C.2.12: Average quarterly photon dose equivalent input values measured in selected monitoring points in the TLD territorial network in 2008 [nSv/hr]

Monitoring point	I/08	II/08	III/08	IV/08	Average
Benešov	109	115	119	112	114
Benešov b	94	97	100	98	97
Beroun	108	108	120	111	112
Beroun b	104		96	109	103
Blansko	90	98	101	95	96
Blatná	150	155	161	153	155
Brandýs nad Labem	84	81	91	85	85
Brno			93	96	95
Brno b	100	114	105	113	108
Broumov	115	112	118	113	115
Bruntál	93	113	99	106	103
Červená Voda	119	135	129		128
Červená Voda b	189	174	167	187	179
Česká Lípa	98	112	102	109	105
Česká Lípa b	103	109		102	105
České Budějovice	131	135	133	137	134
České Budějovice b	156	148	154	158	154
Český Krumlov	128	139	134	137	135
Český Krumlov b	155	162	159	160	159
Děčín	81	80	87	81	82
Dobrá Voda	126	136	141	146	137
Doksy	111	89	97	87	91
Domažlice	90	106	97	94	97
Domažlice b	135	143	132	139	137
Frýdlant nad Ostravicí	80	90	79	86	84
Havlíčkův Brod	124	126	129	124	126
Havlíčkův Brod b	109	97	101	103	103
Hodonín	71	79	76	81	77
Hodonín b	123	120	118	117	120
Hojsova Stráž	120	123	123	111	119
Hradec Králové	93	93	97	111	99
Hradec Králové b	101	97	98	107	101
Hradec Králové - EWN	95	96	104	97	98
Hranice	84	98	86	96	91
Humpolec	134	150	147	144	144
Husinec	105	106	117	107	109
Cheb	90	74	79	79	79
Chrudim	110	114	104	110	110

Churáňov	107	140	138	130	129
Ivančice	104	115	111	107	109
Jaroměřice nad Rokytnou	119	139	132	136	132
Jeseník	79	99	115	81	94
Jeseník b	111	118	112	119	115
Jičín	114	122	114	119	117
Jihlava	90	110	102	114	104
Jihlava b	142	151	158	147	150
Jindřichův Hradec	120	130	138	129	129
Jindřichův Hradec b	127	141	130	133	133
Karlovy Vary	132	138	143	137	138
Karlovy Vary b	89	81	88	89	87
Kladno	108	105	110	108	108
Klatovy	101	100	111	97	102
Klatovy b	128	130	126	135	130
Kolín	88	89	95	90	91
Koryčany	104	96	120	99	105
Košetice	133	127	148	123	133
Košetice b	108	94	109	99	103
Kralovice	91	101	98	93	96
Kraslice	114	125	131	127	124
Kroměříž	83	104	92	90	92
Kutná Hora	73	73	74	75	74
Kutná Hora b	124		105	117	115
Liberec	155	165	157	159	159
Liberec b	150	164	154	166	159
Litoměřice	117	95	100	92	101
Litoměřice b		116	116	116	116
Louny	93	103	101	101	100
Mariánské Lázně	96	97	99	98	98
Mariánské Lázně b	86	82	94	91	88
Měděnec	85	102	98	91	94
Mělník	87	91			89
Mělník b	110	106	112	112	110
Mikulov	90	91	102	85	92
Milevsko	162	179	172	173	172
Milevsko b	155	169	156	144	156
Mladá Boleslav	82	82	89	82	84
Mladá Boleslav b	109	110	104	108	108
Mníšek pod Brdy	108	102	109	105	106
Most	95	100	101	99	99
Most b	107	111	101	109	107
Náchod	111	97	107	91	102
Náchod b	94	95	85	108	96
Nepomuk	152	145	157	145	150
Nová Bystřice	126	146	145	143	140
Nová Říše	112	123	123	118	119
Nová Ves v Horách	91	110	103	105	102
Nové Město pod Smrkem	89	96	90	91	92
Nový Jičín	88	98	90	97	93
Nymburk	85	83	88	84	85
Nymburk b	111	103	108	106	107
Odry b	103	101	106	99	102
Olešník	136	117	132	121	127
Olomouc	78	92	83	97	88
Olomouc b	96	116	102	113	107
Opava	90	92	85	88	89
Opava b	98	102	98	104	101
Opočno	102	92	106	103	101
Osoblaha	108	113	102	110	108
Ostrava - Poruba Hospital	101	100	110	101	103
Ostrava - Syllabova	102	103	106	99	103
Ostrava - Syllabova b	86	114	100	113	103
Praha 1 - SÚJB - EWN	99	91	98	98	97
Praha 1 - SÚJB b	115	107	110	110	111
Praha 10 - Hostivař	122	119	136	123	125
Praha 10 - SZÚ - EWN	92	91	99	95	94
Praha 4 - Libuš - west	107	92	104	97	100
Praha 4 - Libuš - west b	95	100	103	104	101
Praha 4 - SÚRO	125	123	120		123
Praha 4 - SÚRO b	116	106	111	108	110

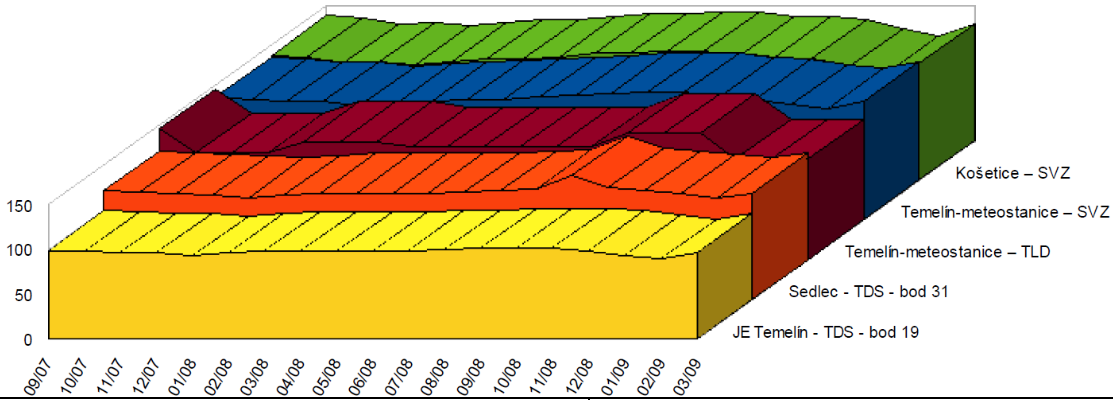
Praha 5 - Na Černém vrchu	108	102	105	107	106
Praha 5 - Na Černém vrchu b	130	115	131	120	124
Praha 6 - Ruzyně - airport	93	91	101	92	94
Praha 7 - Zoological garden	89	87	99	93	92
Praha 8 - Za střelnicí	115	111	121	115	116
Praha 8 - Za střelnicí b	120	110	118	120	117
Pardubice	112	106	114	96	107
Pec pod Sněžkou	100	129	129	123	120
Pec pod Sněžkou b	116	123	120	131	123
Pelhřimov	172	151	182	155	165
Pelhřimov b	176	181	178	195	183
Písek	134	141	149	139	141
Písek b	170		179	162	170
Plzeň	95	87	101	91	94
Plzeň - EWN	98	94	103	105	100
Plzeň b	123	126	112	127	122
Prachatice	115	127	126	137	126
Prachatice b	116	110	111	118	114
Prostějov	87	113	96	96	98
Přerov	85	100	96	102	96
Příbram	110	108	114	113	111
Příbram b	175	162	181	169	172
Přimda	105	113	125	107	113
Přimda b	141	134	124	141	135
Rakovník	195	195	201	205	199
Rakovník b	185	179	158	161	171
Rychnov nad Kněžnou	98	101	101	100	100
Řež	92	94	103	93	96
Sedlčany	181	176	190	181	182
Semily	120	107	100	91	105
Soběslav	92	106	100	103	100
Souš	78	126	124	129	114
Staňkov	95	104	100	101	100
Staňkovice	119	120	135	120	124
Strakonice		143		134	139
Strakonice b	133	124	141	141	135
Strání	88	91	95	92	92
Stříbro	97	103	100	102	101
Stříbro b	129	122	122	119	123
Svitavy	104	108	112	112	109
Šluknov	91	95	96	98	95
Šumperk	84	100	101	98	96
Tábor	162	174	178	179	173
Tábor b	140	150	143	159	148
Temelín	117	126	133		125
Teplice	149	154	148	153	151
Trutnov	119	136	123	132	128
Třebíč	153	160	160	155	157
Třinec	79	88	75	79	80
Uherské Hradiště	101	102	107	96	102
Uničov	94	110	98	106	102
Ústí nad Labem - Habrovice	80	81	74	82	79
Ústí nad Labem - Habrovice b	125	127	121	129	126
Ústí nad Labem - Kočkov	103	107	104	104	105
Ústí nad Labem - Střekov	80	91		89	87
Ústí nad Orlicí	107	117	113	116	113
Vír	109	121	123	119	118
Vítkov	106	114	112	105	109
Vlašim	94	98	107	101	100
Volary	121	126	135	123	126
Vranov nad Dyjí	90	101	95	94	95
Vsetín	88	91	89	87	89
Vyškov	101	116	108	111	109
Vyšší Brod	166	165		148	160
Zákřany	112	131	123	125	123
Zbiroh	96	111	100	108	104
Zbiroh b	103	102	100	102	102
Zlín	88	88	92	85	88
Zlín b	97	95	100	102	99
Znojmo	104	115	115	116	113
Znojmo b	115	116	119		117

Žatec	88	104	90	105	97
Žatec b	129	135	126	138	132
Žďár nad Sázavou	102	119	114	110	111
Žlutice	107	84	111	90	98
Žlutice b	145	137	138	145	14

Note: b after the description of the monitoring point means that the monitoring point is located in a building.

For illustration, the following figure shows the comparison of the PDEI time distribution from 2007 to 2009 in the selected EWN, TDS and TLD monitoring points. No cases exceeding the intervention levels were registered. It further follows from the figure that the results of monitoring using EWN and the territorial TLD network are comparable to each other in individual years.

Figure C.2.37: The time distribution of the photon dose equivalent input (average monthly values), 2007-2009 [nSv/h]



JE Temelín - TDS - bod 19	Temelín NPP - TDS - point 19
Sedlec - bod - 31	Sedlec - point 31
Temelín meteostanice - TLD	Temelín meteo station - TLD
Temelín meteostanice - SVZ	Temelín meteo station - Early Detection Network
Košetice - SVZ	Košetice - Early Detection Network

Monitoring of the environment

Monitoring of the environment is the responsibility of the Central Laboratory of the monitoring network, air pollution monitoring points (APMP), water pollution monitoring points (WPMP) and RMS laboratory groups.

The following environmental components are monitored: air (aerosols, gases, fall-outs), drinking and surface water, water-treatment sludge and river sediments, soil and vegetation.

As for the aerosols and fall-outs from the whole territory of the Czech Republic, the attention is focused on ^{137}Cs (for comparison, the data for the natural radionuclides ^{7}Be and ^{210}Pb are also specified). In the case of the air pollution monitoring point in SÚRO Praha, the data for other monitored radionuclides, ^{3}H, ^{14}C, ^{22}Na, ^{40}K, ^{85}Kr, ^{90}Sr, ^{238}Pu, ^{239,240}Pu, are also specified. For drinking and surface waters ^{3}H, ^{137}Cs and ^{90}Sr are monitored, while ^{137}Cs is monitored in water-treatment sludge and river sediments.

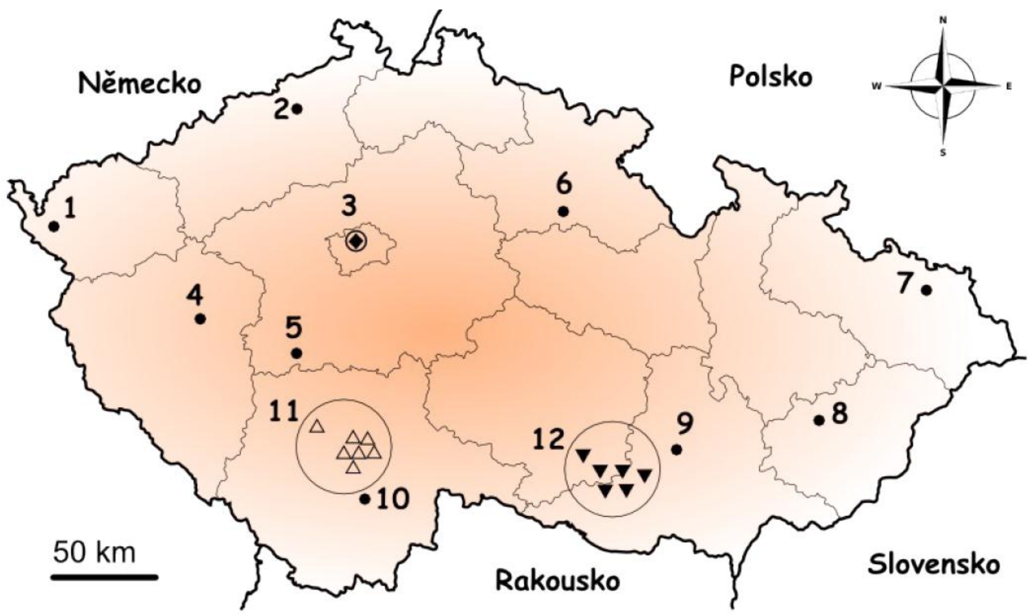
The origin of the specified radionuclides detected in APMP is as follows:

- ^{137}Cs, which is at present measurable in the air, comes mainly from dust resuspension from the contaminated Earth surface as a result of the NPP Chernobyl accident; the residues of nuclear weapon testing in the atmosphere are already insignificant today;
- ^{7}Be and ^{22}Na are formed as a result of the impact of secondary components of cosmic radiation on the atoms of the gases present in the upper layers of the atmosphere;
- ^{210}Pb is a product of the transformation of elements of the uranium family contained in the Earth's crust;
- ^{40}K is contained in the Earth's crust;

- the balance activity of ^{85}Kr in the atmosphere coming from natural sources (spontaneous uranium fission, nuclear reactions in the upper layers of the atmosphere) is insignificant compared to its present content in the atmosphere which results from release by nuclear fuel reprocessing and nuclear power plant operation; only a minor part of anthropogenic ^{85}Kr comes from nuclear weapon testing;
- ^{238}Pu measurable in the air comes from resuspension of the polluted upper soil layer where it was mainly deposited from the fall-out from atmospheric nuclear tests and from the destruction of the SNAP-9A satellite (6.7.10^{14} Bq ^{238}Pu) in the Earth's atmosphere; the equivalent from the NPP Chernobyl accident is very small;
- $^{239+240}$Pu measurable in the air also comes from resuspension from the polluted upper soil layer affected by fall-out from atmospheric nuclear tests; the equivalent from the NPP Chernobyl accident is very small;
- ^{90}Sr is present in the environment as a result of nuclear tests in the atmosphere; the equivalent from the NPP Chernobyl accident to the activity of ^{90}Sr in our territory is insignificant;
- the activity of ^{14}C in the air is given mainly by its natural production in higher atmospheric layers by the impact of cosmic radiation; the activity of ^{14}C in the air increased as a result of nuclear weapon testing; after they stopped, the activity of atmospheric ^{14}C dropped as a result of its transfer to other components of the environment (ocean waters, sediments, biota) as well as due to fossil fuel combustion (fossil carbon does not contain ^{14}C and thus the content of ^{14}C is diluted in the carbon isotopic mixture); the current, although insignificant sources of anthropogenic ^{14}C in the environment include nuclear power facilities (nuclear reactors and fuel reprocessing plants); the annual emissions of the man-made ^{14}C in the environment make approximately 10% of natural production; in gaseous discharges of NPP Temelín during normal operation, ^{14}C represents more than 80%.
- ^{3}H is a globally present radionuclide. It is formed naturally in the atmosphere as a result of the impact of secondary components of cosmic radiation on the atoms of the gases that are present there; the naturally formed ^{3}H is increased by ^{3}H formed as a result of nuclear weapon testing and present-day anthropogenic production mainly from nuclear power facilities.

The radionuclides in the air are currently monitored in the territorial network of 10 air pollution monitoring points (APMP), provided with the equipment for the sampling of aerosol and gaseous forms of iodine that are operated by RC SÚJB, SÚRO and CHMI. The following figure shows the RMS APMPs that are currently operated.

Figure C.2.38: Aerosol sampling points in the operational RMS territorial network, 2008



Sampling site description: | Flow-rate:

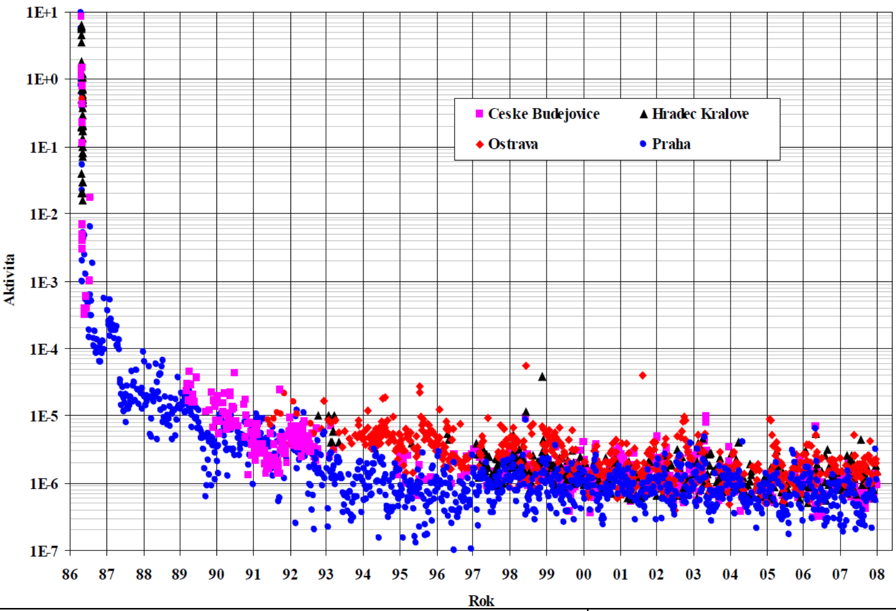
Sampling site description:	Flow-rate:
1. CHMI Cheb	150 m^3/h
2. RC SÚJB Ústí nad Labem	150 m^3/h
3. SÚRO Praha	900 m^3/h
4. RC Plzeň	150 m^3/h

5. RC Kamenná	150 m^3/h
6. SÚRO Hradec Králové	150 m^3/h
7. SÚRO Ostrava	150 m^3/h
8. CHMI Holešov	150 m^3/h
9. SÚRO Brno	150 m^3/h
10. RC České Budějovice	150 m^3/h
LRKO EDU (6 stations), local network	40 m^3/h
LRKO ETU (7 stations), local network	40 m^3/h

Note: the fall-out is also collected in the sampling sites except for CHMI Cheb, CHMI Holešov and the NPP neighbourhood.

The following figure shows the time courses of weekly values of volume activities of ^{137}Cs in aerosols in the period of 1986-2007 from 4 APMPs (Praha, Hradec Králové, Ostrava and České Budějovice). APMP Hradec Králové represents a location with a relatively lower "post-Chernobyl" fall-out; on the other hand, in APMP Ostrava the fall-out was higher. APMP Praha is provided with the equipment with the highest sampling and the most sensitive technology, so ^{137}Cs is mostly reliably measurable. APMP České Budějovice can be considered a location rather close to NPP Temelín, i.e. representing its neighbourhood.

Figure C.2.39: Time courses of weekly values of volume activities of ^{137}Cs [Bq/m^3] in aerosols from 4 APMPs

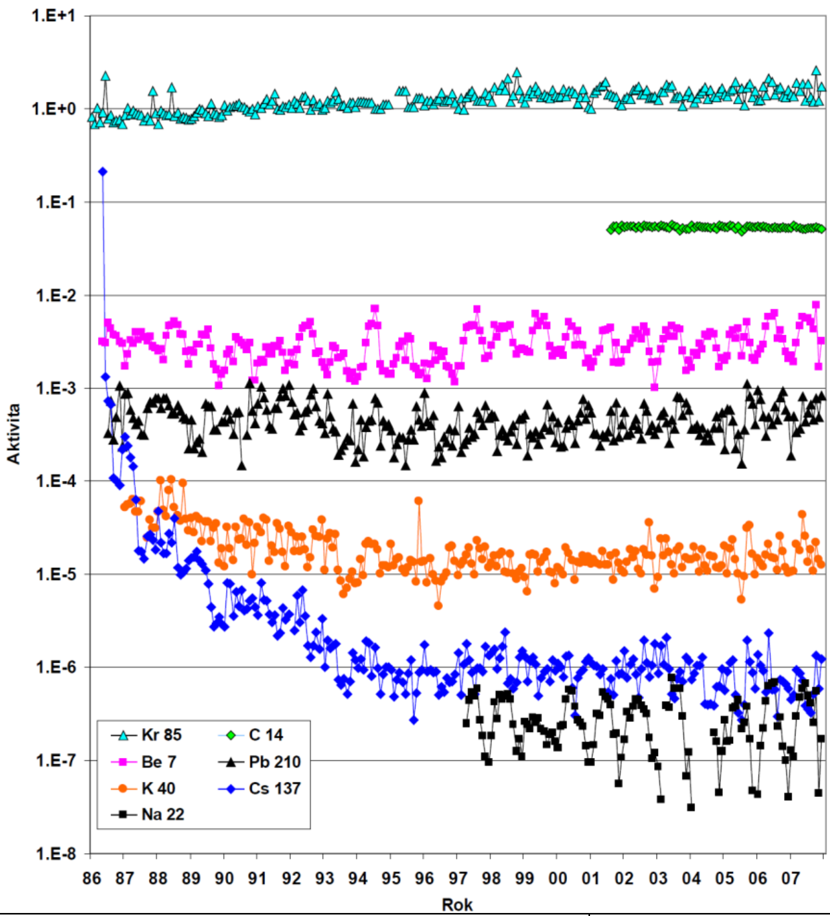


Aktivita	Activity
Rok	Year

Note: On the first initial days after the NPP Chernobyl accident, the values of volume activities higher than 10 Bq/m^3 were measured.
For transparency reasons, the figure does not show the values of MVA.

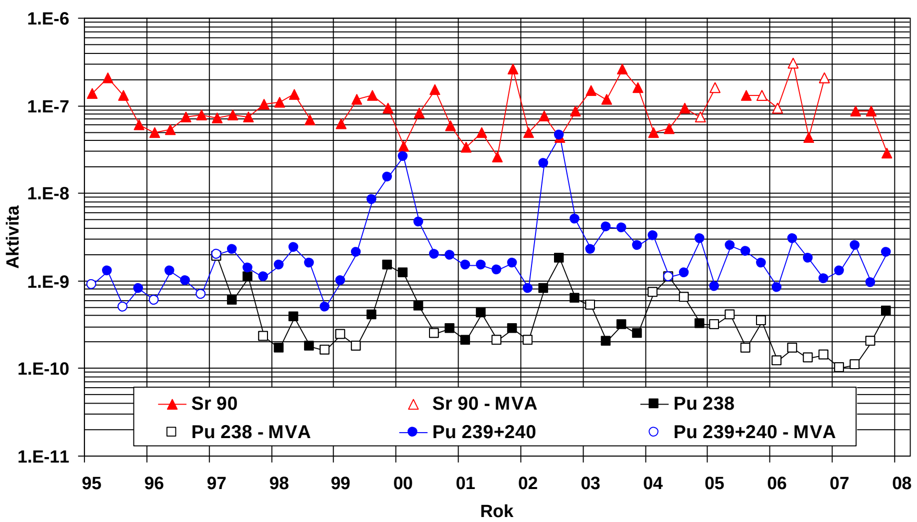
The following figures show the time courses of volume activities of all radionuclides monitored in APMP Praha. The monthly values of nuclide activities that can be established using gamma spectrometry were obtained as weighted means of weekly values. If the activity was below MVA, its value was estimated as ½ MVA. ^{14}C and ^{85}Kr are set in monthly intervals, ^{90}Sr and plutonium isotopes in quarterly intervals. The first shown value for ^{137}Cs is the mean value for May 1986. The specific activity of ^{85}Kr increases very slowly during the whole time of monitoring. In recent years, however, the significant inter-annual changes in the average values of the volume activity of this radioisotope are not detected. This expected increase is caused by the global development of nuclear power facilities, mainly by discharges from fuel reprocessing plants.

Figure C.2.40: Monthly average volume activities of nuclides, APMP Praha [Bq/m³]



Aktivita	Activity
Rok	Year

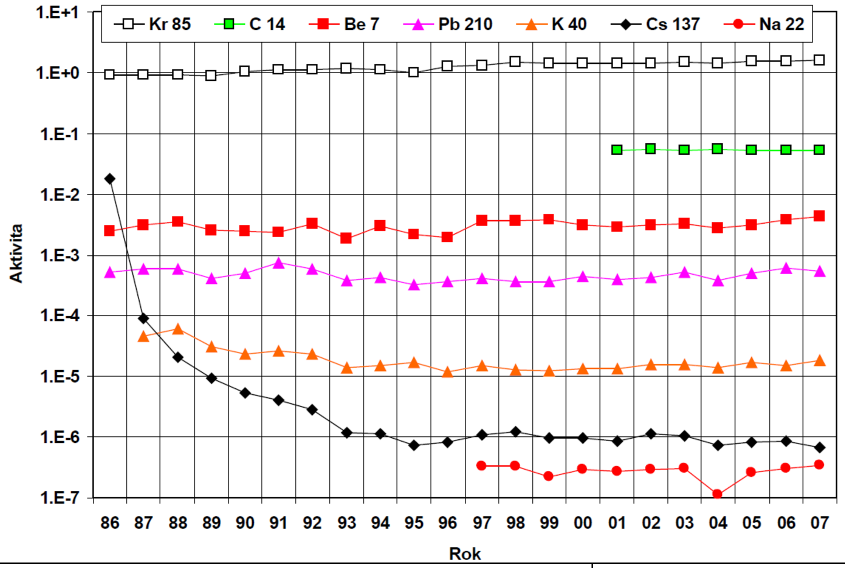
Figure C.2.41: Quarterly average volume activities of ^{90}Sr, ^{238}Pu and ^{239,240}Pu, APMP Praha [Bq/m³]



Aktivita	Activity
Rok	Year

The next figure shows the annual average values of volume activities for selected radionuclides.

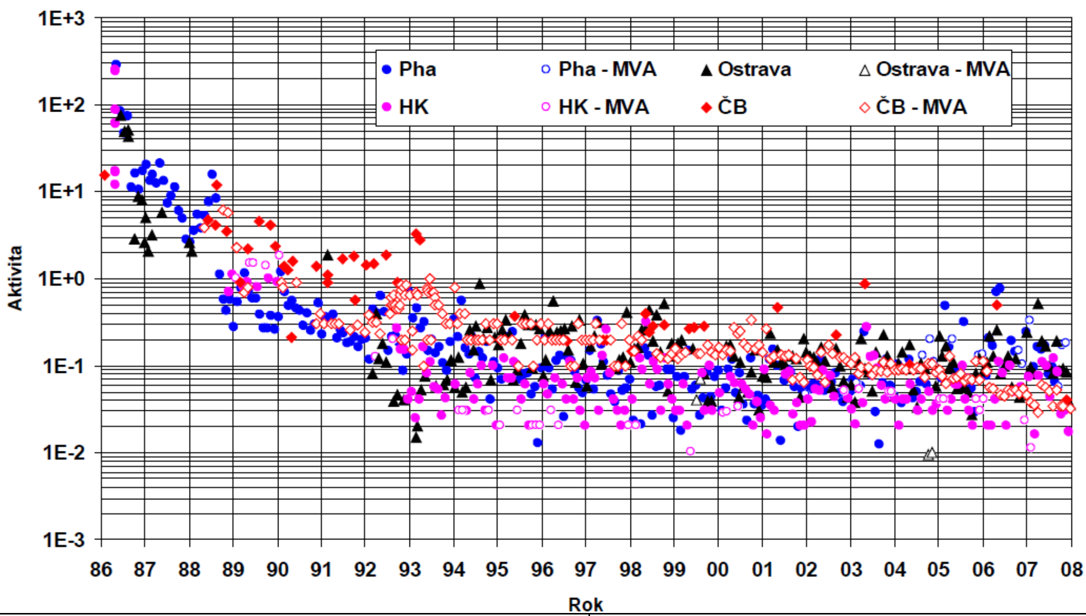
Figure C.2.42: Annual average volume activities of nuclides [Bq/m^3], APMP Praha



Aktivita	Activity
Rok	Year

The content of ^{137}Cs in fall-outs mainly results from resuspension from the soil surface and settling as like for the aerosols. In the territorial part of RMS, the fall-outs are monitored in the same APMPs (and several others) like aerosol monitoring except for APMP Holešov and Cheb. The following figures show the time courses of monthly values for area activities of ^{137}Cs in fall-outs in 4 APMPs (Praha, Hradec Králové, Ostrava and České Budějovice).

Figure C.2.43: Monthly area activities in fall-outs [Bq/m^2] from 4 APMPs

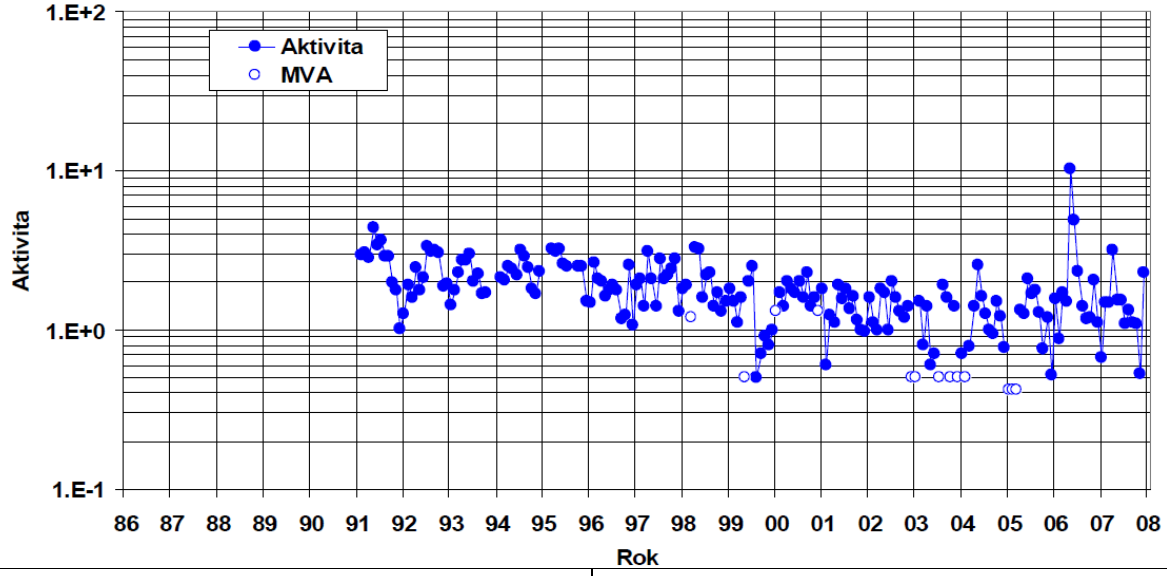


Aktivita	Activity
Rok	Year

It is obvious that all values form a band approximately 1 order wide, where the displayed points from APMP České Budějovice represent the values corresponding to MVA in most cases, i.e. the actual values of area activity are lower than these MVA values.

^{3}H in precipitation is another radionuclide that is monitored in the long term by MMKO Praha. The following figures show the volume activities of ^{3}H in rainwater.

Figure C.2.44: Monthly average volume activities [Bq/m3] for ^{3}H in rainwater, 1986-2007, APMP Praha



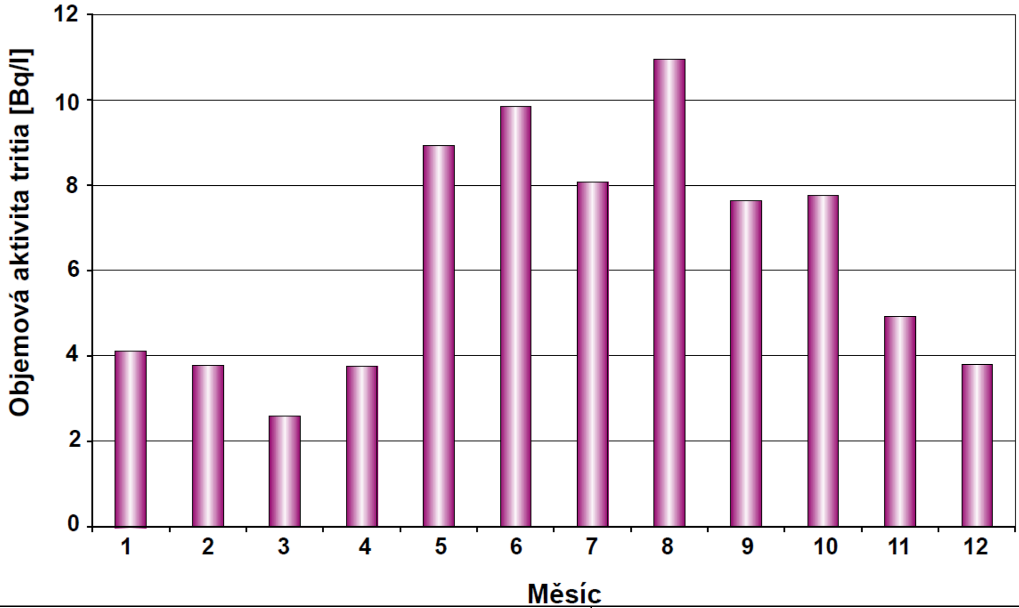
Aktivita	Activity
Rok	Year

The measured values of fall-outs confirmed the fact that the activities have almost remained unchanged in the last decade and that there have been no significant deviations in the content of man-made radionuclides in the air (in many cases the values are below MVA).

In the samples of drinking water, the activity of ^{137}Cs, ^{90}Sr and ^{3}H was monitored in water pollution monitoring points (WPMP). In addition, the samples of surface water were monitored for the total volume activity of beta radiation. The large sources of drinking water and selected surface waters were monitored. T.G.M. WRI Praha, SÚRO, CHMI and Povodí ČR participated in the monitoring.

The specific activities of ^{3}H in the samples extracted in the locations unaffected by the discharge from nuclear facilities (Odra, Ohře) are almost identical. Higher values and their changeability in the locations of Labe - Hřensko and Morava - Moravský Svatý Ján are caused by discharges from NPPs, nevertheless even these values are low and subject the inhabitants in the NPPs' neighbourhoods to an insignificant radiation load. The time course of the volume activity of ^{3}H in the Labe - Hřensko segment is shown in the following figure. Detailed information regarding the surface waters in the Vltava segments affected by NPP Temelín waters is given below in part C.2.3.3.2.3.

Figure C.2.45: Specific activity of ^{3}H [Bq/l] in surface waters, 2008 - Labe basin, Hřensko segment (Labe)



Objemová aktivita tritia	Volumetric activity of tritium
Měsíc	Month

The specific activities of ^{137}Cs and ^{90}Sr are also very low in all monitored locations. As an example, the following tables show the results of monitoring for 2008. For comparison, the streams affected by NPP Dukovany are also included. Besides in waters, ^{137}Cs is also monitored in the river sediment and water-treatment sludge; the sampling and measurement is provided by TGM WRI in the samples taken from the locations near large sources of drinking water. The specific activities of ^{137}Cs in the water-treatment sludge and river sediments are low and do not change much in the course of the years - for illustration, the activity in the water-treatment sludge in Římov (the Malše) in 2005 to 2008 equalled 116, 190, 100 and 120 Bg/kg of dry substance.

Table C.2.10: Specific activity of ^{3}H in selected drinking water sources, 2008 (sampled by SÚRO Prague and Povodí, s.p.; measured by SÚRO Prague and TGM WRI Prague)

River basin - sampling site	Specific activity [Bq/l]			
	1st quarter	2nd quarter	3rd quarter	4th quarter
Labe - Kárany (Jizera)	0.63	1.7	1.4	0.88
Vltava - Jesenice (Želivka)	0.5	1.7	1.3	1.6
Odra - Kružberk (Moravice)	0.98	0.58	0.59	1.3
Ohře - Fláje (Flájský potok)	< 0.57	1.35	< 0.55	0.97
Labe - Křižanovice (Chrudimka)	0.99	< 0.55	1.1	1.1
Morava - Vír (Svratka)	0.84	0.88	0.59	0.95
Vltava - Římov (Malše)	0.7	1.2	0.89	0.57

Note The value following the "<" sign = minimum significant activity at the 95% confidence level

Table C.2.11: Specific activity of ^{137}Cs in selected drinking water sources, 2008 (sampled by SÚRO Prague and Povodí, s.p.; measured by SÚRO Prague and TGM WRI Prague)

River basin - sampling site	Specific activity [Bq/l]			
	1st quarter	2nd quarter	3rd quarter	4th quarter
Labe - Kárany (Jizera)	< 4.4.10^{-5}	< 1.2.10^{-4}	2.2.10^{-4}	< 1.1.10^{-4}
Vltava - Jesenice (Želivka)	< 9.5.10^{-5}	8.6.10^{-4}	< 1.3.10^{-4}	< 1.9.10^{-4}
Odra - Kružberk (Moravice)	< 7.0.10^{-4}	< 8.0.10^{-4}	< 7.0.10^{-4}	< 9.0.10^{-4}
Ohře - Fláje (Flájský potok)	1.7.10^{-3}	1.4.10^{-3}	1.1.10^{-3}	1.0.10^{-3}
Labe - Křižanovice (Chrudimka)	< 1.0.10^{-3}	< 7.0.10^{-4}	< 7.0.10^{-4}	6.0.10^{-4}
Morava - Vír (Svratka)	< 7.0.10^{-4}	6.0.10^{-4}	< 4.0.10^{-4}	< 8.0.10^{-4}
Vltava - Římov (Malše)	< 6.0.10^{-4}	< 8.0.10^{-4}	8.0.10^{-4}	8.0.10^{-4}

Note The value following the "<" sign = minimum significant activity at the 95% confidence level

Table C.2.12: Specific activity of ^{90}Sr in selected drinking water sources,2008 (sampled by SÚRO Prague and Povodí, s.p.; measured by SÚRO Prague and TGM WRI Prague)

River basin - sampling site	Specific activity [Bq/l]			
	1st quarter	2nd quarter	3rd quarter	4th quarter
Labe - Káraný (Jizera)	$9.3.10^{-3}$	$2.5.10^{-3}$	$2.5.10^{-3}$	$3.0.10^{-3}$
Vltava - Jesenice (Želivka)	$5.8.10^{-3}$	$4.1.10^{-3}$	$4.0.10^{-3}$	$3.0.10^{-3}$
Odra - Kružberk (Moravice)	$< 2.4.10^{-3}$	$< 1.8.10^{-3}$	$< 3.3.10^{-3}$	$< 1.6.10^{-3}$
Ohře - Fláje (Flájský potok)	$< 3.2.10^{-3}$	$3.1.10^{-3}$	$5.3.10^{-3}$	$< 6.4.10^{-3}$
Labe - Křižanovice (Chrudimka)	$< 5.2.10^{-3}$	$3.4.10^{-3}$	$3.8.10^{-3}$	$< 1.7.10^{-3}$
Morava - Vír (Svratka)	$< 3.0.10^{-3}$	$3.5.10^{-3}$	$3.0.10^{-3}$	$7.1.10^{-3}$
Vltava - Římov (Malše)	$< 2.8.10^{-3}$	$3.4.10^{-3}$	$< 2.2.10^{-3}$	$< 2.9.10^{-3}$

Note The value following the "<" sign = minimum significant activity at the 95% confidence level

Table C.2.13: Specific activity of ^{3}H in surface waters, 2008 (sampled and measured by SÚRO Povodí, s.p., and TGM WRI Prague)

River basin - sampling site	Specific activity [Bq/l]			
	1st quarter	2nd quarter	3rd quarter	4th quarter
Odra - Bohumín (Odra)	0.82	0.83	0.96	< 0.55
Odra - Kružberk (Moravice)	0.98	< 0.58	0.59	< 0.55
Ohře - Fláje (Flájský potok)	< 0.58	< 0.55	0.74	0.80
Ohře - Přísečnice (Přísečnický potok)	< 0.58	0.56	1.3	< 0.54
Labe - Hřensko (Labe)	4.9	6.1	9.7	8.7
Labe - Křižanovice (Chrudimka)	< 0.56	0.56	1.4	1.5
Morava - Moravský Svatý Ján (Morava)	1.8	1.9	4.8	2.9
Morava - Vír (Svratka)	0.6	0.94	1.5	0.65
Vltava - Švihov (Želivka)	<057	0.89	1.6	1.1
Vltava - Římov (Malše)	< 0.55	0.8	0.78	1.4

Table C.2.14: Specific activity of ^{137}Cs in surface waters, 2008 (sampled and measured by SÚRO Povodí, s.p., and TGM WRI Prague)

River basin - sampling site	Specific activity [Bq/l]			
	1st quarter	2nd quarter	3rd quarter	4th quarter
Odra - Bohumín (Odra)	$2.6.10^{-3}$	$7.2.10^{-3}$	$2.3.10^{-3}$	$1.1.10^{-3}$
Odra - Kružberk (Moravice)	$< 8.0.10^{-4}$	$< 9.0.10^{-4}$	$< 8.0.10^{-4}$	$< 9.0.10^{-4}$
Ohře - Fláje (Flájský potok)	$1.5.10^{-3}$	$1.0.10^{-3}$	$2.0.10^{-3}$	$1.1.10^{-3}$
Ohře - Přísečnice (Přísečnický potok)	$< 8.0.10^{-4}$	$< 8.0.10^{-4}$	$< 8.0.10^{-4}$	$< 8.0.10^{-4}$
Labe - Hřensko (Labe)	$< 7.0.10^{-4}$	$1.4.10^{-3}$	$7.8.10^{-4}$	$1.2.10^{-3}$
Labe - Křižanovice (Chrudimka)	$< 7.0.10^{-4}$	$< 7.0.10^{-4}$	$< 1.0.10^{-3}$	$< 1.1.10^{-3}$
Morava - Moravský Svatý Ján (Morava)	$6.1.10^{-3}$	$< 7.0.10^{-4}$	$< 1.0.10^{-3}$	$< 1.1.10^{-3}$
Morava - Vír (Svratka)	$< 8.0.10^{-4}$	$< 6.0.10^{-4}$	$8.0.10^{-4}$	$< 8.0.10^{-4}$
Vltava - Švihov (Želivka)	$< 9.0.10^{-4}$	$< 7.0.10^{-4}$	$< 9.0.10^{-4}$	$< 8.0.10^{-4}$
Vltava - Římov (Malše)	$5.0.10^{-4}$	$5.0.10^{-4}$	$7.0.10^{-4}$	$< 9.0.10^{-4}$

Table C.2.15: Total specific beta activity after subtraction of ^{40}K and specific activity of ^{90}Sr in surface waters, 2008 (sampled and measured by Povodí, s.p., VÚV TGM Praha)

River basin - sampling site	Specific activity [Bq/l]				
	Total beta minus ^{40}K				^{90}Sr
	1st quarter	2nd quarter	3rd quarter	4th quarter	Year
Odra - Bohumín (Odra)	$7.0.10^{-2}$	$8.1.10^{-2}$	$< 2.7.10^{-2}$	$< 2.4.10^{-2}$	$3.5.10^{-3}$
Odra - Kružberk (Moravice)	$< 2.0.10^{-2}$	$1.6.10^{-2}$	$< 6.0.10^{-3}$	$< 1.1.10^{-2}$	$3.9.10^{-3}$
Ohře - Fláje (Flájský potok)	$1.6.10^{-2}$	$< 3.0.10^{-2}$	$5.4.10^{-2}$	$1.8.10^{-2}$	$< 2.9.10^{-3}$
Ohře - Přísečnice (Přísečnický potok)	$2.8.10^{-2}$	$< 4.0.10^{-3}$	$6.0.10^{-3}$	$< 4.0.10^{-3}$	$< 3.3.10^{-3}$
Labe - Hřensko (Labe)	$1.6.10^{-2}$	$< 1.7.10^{-2}$	$5.5.10^{-2}$	$4.1.10^{-2}$	$2.4.10^{-3}$
Labe - Křižanovice (Chrudimka)	$3.4.10^{-2}$	$1.0.10^{-2}$	$5.8.10^{-2}$	$2.1.10^{-2}$	$4.6.10^{-3}$
Morava - Moravský Svatý Ján (Morava)	$5.2.10^{-01}$	$7.5.10^{-2}$	$2.5.10^{-2}$	$4.7.10^{-2}$	$1.6.10^{-3}$
Morava - Vír (Svratka)	$6.1.10^{-2}$	$4.5.10^{-2}$	$< 2.5.10^{-2}$	$< 4.3.10^{-2}$	$9.3.10^{-3}$
Vltava - Švihov (Želivka)	$< 1.8.10^{-2}$	$2.1.10^{-2}$	$< 1.9.10^{-2}$	$< 2.1.10^{-2}$	$1.0.10^{-2}$
Vltava - Římov (Malše)	$1.0.10^{-01}$	$5.1.10^{-2}$	$6.2.10^{-2}$	$2.6.10^{-2}$	$< 1.3.10^{-3}$

Food chain monitoring

Food chain monitoring is the responsibility of the Central Laboratory of the SÚRO monitoring network, laboratory teams and food contamination measuring sites (MMKP), falling under the State Office for

Nuclear Safety, Ministry of Agriculture and Ministry of the Environment. The radionuclide determined in food chain components is ^{137}Cs; ^{90}Sr is also determined in selected commodities. The foods monitored include milk, meat, fish, game, potatoes, cereals, vegetables, fruit, honey, forest fruits, mushrooms and animal feed, taken for sampling from both the distributors (the shop network) and the producers.

The mean values and other statistical data of specific activities of ^{137}Cs in selected commodities in the Czech Republic, 1992-2007 plus data for 2008, are given in the tables below.

Table C.2.16: Mean values, geometric standard deviation and 95% tolerance interval for ^{137}Cs activities in selected types of food in the Czech Republic, 1992-2007

Commodity	Number of data	Fraction < MVA	AM	GM	GSD	95% TI
			[Bq/kg; milk: Bq/l]			[Bq/kg; milk: Bq/l]
Beef	1,424	47%	0.31	0.10	4.5	$4.9.10^{-3}$ - 2.1
Pork	812	61%	0.13	0.062	3.4	$5.0.10^{-3}$ - 0.76
Poultry	373	73%	0.055	0.031	3.0	$3.0.10^{-3}$ - 0.31
Milk (liquid)	844	36%	0.035	0.018	3.1	$1.7.10^{-3}$ - 0.19
Cereals	265	72%	0.046	0.026	2.9	$2.6.10^{-3}$ - 0.26
Fruit	384	78%	0.086	0.011	7.4	$1.6.10^{-4}$ - 0.83
Vegetables	577	70%	0.11	0.019	6.4	$3.9.10^{-4}$ - 0.94

Note: Statistical data were estimated based on the parameters of the assumed log-normal data distribution

- Fraction < MVA = Number of values lower than MVA (lowest significant activity) as the percent fraction of the total number of data
- AM = Arithmetic mean
- GM = Geometric mean
- GSD = Geometric standard deviation
- 95% TI = 95% tolerance interval (interval encompassing 95% data)
- Cereals = wheat + rye

Table C.2.17: Specific activities of ^{137}Cs in selected foods and specific activities of ^{90}Sr in milk (2008). Samples were taken from the distributors and producers. (Sampling: RC SÚJB, SÚRO, SVÚ, SZPI and VÚLHM and VÚV TGM; measurement: RC SÚJB, SÚRO and SVÚ a VÚV)

Component	Unit	Range	Number of measurements	
			Total	> MVA
^{137}Cs				
Milk	Bq/l	$1.0.10^{-2}$ - $1.8.10^{-1}$	68	26
Milk powder	Bq/kg	< $5.0.10^{-2}$ - 2.5	71	68
Beef	Bq/kg	< $4.2.10^{-2}$ - 2.4	287	207
Pork	Bq/kg	$2.2.10^{-2}$ - 2.4	120	38
Poultry	Bq/kg	< $9.5.10^{-3}$ - $5.2.10^{-1}$	64	28
Other meat	Bq/kg	< $4.7.10^{-2}$ - 1.4	12	5
Game	Bq/kg	< $5.0.10^{-2}$ - $2.6.10^{3}$	105	75
Fish	Bq/kg	< $5.0.10^{-2}$ - 3.2	54	37
Honey	Bq/kg	< $5.0.10^{-2}$ - $1.3.10^{1}$	18	4
Fruit	Bq/kg	< $3.0.10^{-3}$ - $2.5.10^{-1}$	34	10
Vegetables	Bq/kg	< $5.0.10^{-3}$ - $9.9.10^{-1}$	36	9
Potatoes	Bq/kg	< $1.0.10^{-2}$ - 1.3	32	22
Cereals	Bq/kg	$2.4.10^{-2}$ - $1.8.10^{-1}$	4	4
Forest fruits	Bq/kg	$2.4.10^{-2}$ - $3.8.10^{2}$	30	29
Forest mushrooms	Bq/kg	< $1.5.10^{-1}$ - $1.2.10^{4}$	68	66
^{90}Sr				
Milk	Bq/l	< $8.0.10^{-3}$ - $7.0.10^{-2}$	16	13

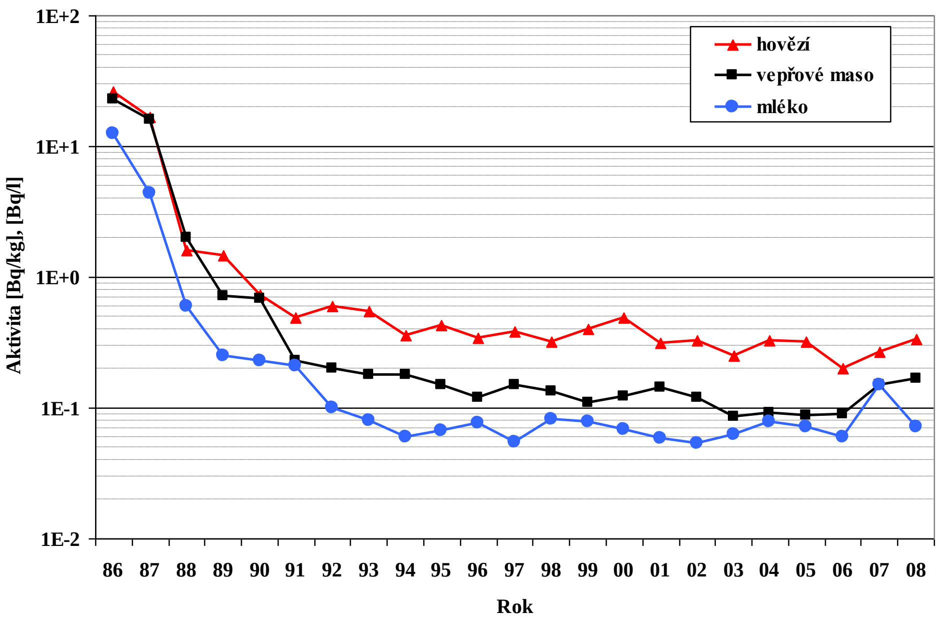
Note:

- MVA = minimum significant activity at the 95% confidence level
- Due to the different sensitivity of the various measurements, some MVA levels can be higher than the lowest levels measured.
- Range: the measured data range serves as a parameter describing the data set. Where the group of data include values below the MVA, the lowest value in the group is given as the lower limit of the range. Where this level is the MVA, the "<" sign is added.
- The total number of cereal samples was 67, the data, however, largely lay below the MVA. In such cases a mixed sample for the whole country is formed and pre-concentrated by incineration. The 4 samples represent wheat, rye, barley and oats.

Many data are seen to lie below the MVA.

The annual arithmetic means of the specific activities in beef, pork and milk (monitored by the SÚJB and SÚRO) are shown in the figure below.

Figure C.2.46: Mean annual specific activities of ^{137}Cs in pork and beef [Bq/kg] and in milk [Bq/l], 1986-2008 (sampling and measurement: SÚRO and RC SÚJB)



Aktivita	Activity
Rok	Year
Hovězí	Beef
Vepřové maso	Pork
Mléko	Milk

The ^{137}Cs activities in the food commodities are at the levels of hundredths to tenths of Bq/kg (Bq/l). The specific activities of this radionuclide in forest fruits, mushrooms and game are higher than in the other foods and their decrease is very slow. The contribution of those commodities to the total committed effective dose from the ingestion of ^{137}Cs has been increasing over the years as the activity of this radionuclide in the remaining commodities has been decreasing; still, the total doses from ingestion obtained by an average individual from the population are very low (below 2 µSv). The ingestion dose is higher but still deeply below 1 mSv in subpopulations where forest fruits, mushrooms and game are eaten to an appreciable extent.

In accordance with the applicable EU recommendation, ^{90}Sr in the daily (mixed) diet has been monitored in the Czech Republic since 2006 [1]. The composition of the daily diet samples is based on an average Czech citizen's market basket taking into account the availability of seasonal foods. The mean specific activities of ^{90}Sr and related statistical data are given in the table below.

Table C.2.18: Mean values, geometric standard deviation and 95% tolerance interval of ^{90}Sr activities in mixed diet in the Czech Republic, 2006-2007

Commodity	Number of data	Fraction < MVA	AM	GM	GSD	95% TI
			[Bq/kg; milk: Bq/l]			[Bq/kg; liquid milk: Bq/l]
Mixed diet	38	1	0.035	0.030	1.7	0.0080 - 0.11

[1] Until 2006, ^{90}Sr was monitored in selected commodities, such as some samples of milk and cereals.

Note:

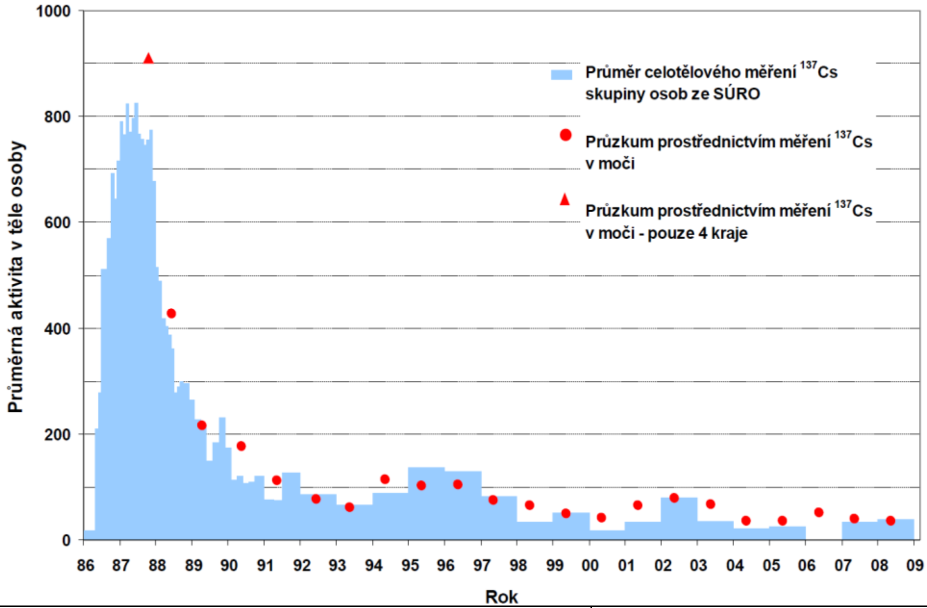
- Fraction < MVA = Number of values lower than MVA (lowest significant activity) as the percent fraction of the total number of data
- AM = Arithmetic mean
- GM = Geometric mean
- GSD = Geometric standard deviation
- 95% TI = 95% tolerance interval (interval encompassing 95% data)

Monitoring of people

Internal contamination of a reference group of 30 individuals (15 men, 15 women, mostly from Prague) with ^{137}Cs has been monitored annually on a whole-body counter of the National Radiation Protection Institute (SÚRO) in Prague. Annual countrywide surveys of internal contamination by ^{137}Cs through measurements of ^{137}Cs excreted with urine within 24 hours (approximately 70 samples per year) has also been performed on individuals whose diet habits match the average population.

The time dependence of ^{137}Cs retention by the Czech population, obtained by measurements in a reference group and by ^{137}Cs measurements in urine (1986-2008), is shown in the graph below. Year-on-year changes in internal contamination by ^{137}Cs are nearly below the limits of observation, as was the case during the longer time period following atmospheric nuclear weapon tests. The annual effective dose from the inhalation and ingestion of ^{137}Cs by a mean individual from the Czech population is very low, it has been typically below 2 μSv in recent years.

Figure C.2.47: Development of ^{137}Cs [Bq] in Czech population following the Chernobyl accident (measurement: SÚRO Praha)



Průměrná aktivita v těle osoby	Average activity in human body
Rok	Year
Průměr celotělového měření 137Cs skupiny osob ze SÚRO	Average full body 137Cs reading in group of persons from State Institute of Radiation Protection
Průzkum prostřednictvím měření 137Cs v moči	Survey by taking 137Cs readings in urine
Průzkum prostřednictvím měření 137Cs v moči – pouze 4 kraje	Survey by taking 137Cs readings in urine – 4 regions only

C.2.3.3.2.2. Monitoring performed by the NPP Temelín operator

The scope of monitoring performed by the plant operator in accordance with monitoring programmes approved by the SÚJB is very wide. This report contains representative and summary data only. The following monitoring results are presented:

- Monitoring of discharges into air and watercourses

- Monitoring of the plant surroundings (relevant environmental and food chain components)

Complete monitoring results are available in the plant operator's office.

Monitoring encompasses man-made radionuclides that may potentially be present in the discharges (their concentrations are frequently below the limit of detection). In the surroundings of the Temelín NPP, ^{137}Cs is monitored in aerosols and fallout; ^{3}H, ^{137}Cs and ^{90}Sr in surface waters; ^{137}Cs and ^{90}Sr in milk; and ^{137}Cs only in the remaining components of the environment. Those are the only man-made radionuclides that are present at measurable levels (and are mostly due to the Chernobyl accident).

A significant part of the monitoring programme covers the nuclear power plant area itself. The purpose of monitoring the surroundings is largely to make sure that the activities of the radionuclides discharged into the environment are very low as compared to the regulatory limits.

The contribution of the plant operation to the radiation burden of the population in the surroundings cannot be ascertained by direct measurement. Instead, it is estimated based on the determination of radionuclides present in gaseous and liquid discharges by using model calculations for the determination of the effective doses to an individual in the critical subpopulation. The RDETE code, authorised by the Czech State Office for Nuclear Safety, has been approved for NPP Temelín. Assessment of the fraction of the authorised limit spent during a calendar year on discharge control and regulation is based on a conservative estimate of the effective doses from external irradiation and committed effective doses from internal irradiation as the sum of products of activities of the various radionuclides discharged into the air or water during a monitoring period and conversion factors.

Monitoring of discharges

The table below displays the activities of radionuclides discharged into air and watercourses between 2002 and 2008[1].

Table C.2.19: Total atmospheric activity discharges of selected radionuclides from NPP Temelín, 2002-2008

Nuclide	A [Bq]						
	2002	2003	2004	2005	2006	2007	2008
^{3}H	$7.58.10^{10}$	$3.26.10^{11}$	$1.30.10^{12}$	$2.13.10^{12}$	$1.62.10^{12}$	$3.69.10^{12}$	$1.41.10^{12}$
^{14}C	$1.34.10^{11}$	$3.35.10^{11}$	$4.09.10^{11}$	$4.12.10^{11}$	$5.61.10^{11}$	$5.04.10^{11}$	$4.42.10^{11}$
^{41}Ar	$2.44.10^{12}$	$3.30.10^{12}$	$1.18.10^{12}$	$1.12.10^{12}$	$1.06.10^{12}$	$1.33.10^{12}$	$9.49.10^{11}$
^{51}Cr			$5.97.10^{6}$	$2.11.10^{5}$	$9.78.10^{5}$	$7.88.10^{5}$	$8.94.10^{5}$
^{54}Mn			$1.81.10^{4}$	$2.63.10^{5}$	$2.22.10^{5}$	$1.90.10^{5}$	$8.04.10^{4}$
^{58}Co			$1.57.10^{6}$	$9.48.10^{5}$	$4.05.10^{5}$	$1.57.10^{5}$	$2.14.10^{5}$
^{60}Co		$3.65.10^{8}$	$5.10.10^{5}$	$2.12.10^{5}$	$2.54.10^{5}$	$2.33.10^{5}$	$1.31.10^{5}$
^{85}Kr			$5.28.10^{5}$	$4.77.10^{10}$	$1.86.10^{11}$	$1.87.10^{11}$	$2.48.10^{11}$
^{85m}Kr	$1.42.10^{12}$	$5.96.10^{11}$	$3.58.10^{10}$	$1.64.10^{11}$	$6.35.10^{10}$	$2.33.10^{11}$	$1.09.10^{11}$
^{87}Kr	$1.20.10^{12}$	$3.85.10^{11}$	$3.72.10^{10}$	$9.66.10^{10}$	$5.31.10^{10}$	$1.63.10^{11}$	$6.60.10^{10}$
^{88}Kr	$3.03.10^{12}$	$9.86.10^{11}$	$7.40.10^{10}$	$2.34.10^{11}$	$9.73.10^{10}$	$4.27.10^{11}$	$1.87.10^{11}$
^{131}I	$8.09.10^{5}$	$1.79.10^{6}$	$1.19.10^{7}$	$5.92.10^{7}$	$1.70.10^{8}$	$2.37.10^{8}$	$5.64.10^{7}$
^{133}I			$3.97.10^{6}$	$6.65.10^{6}$	$2.60.10^{6}$	$4.47.10^{6}$	$5.15.10^{6}$
^{132}Te	$1.06.10^{5}$	$1.66.10^{5}$					
^{133}Xe	$4.29.10^{12}$	$2.52.10^{13}$	$4.77.10^{10}$	$3.00.10^{12}$	$5.66.10^{12}$	$4.74.10^{12}$	$5.09.10^{12}$
^{135}Xe	$6.08.10^{12}$	$3.50.10^{12}$	$3.22.10^{11}$	$9.68.10^{11}$	$5.21.10^{11}$	$1.62.10^{12}$	$6.50.10^{11}$
^{135m}Xe	$2.48.10^{11}$	$2.22.10^{10}$	$3.00.10^{10}$	$3.69.10^{10}$	$3.45.10^{10}$	$7.31.10^{10}$	$3.12.10^{10}$
^{138}Xe	$7.05.10^{10}$	$6.10.10^{10}$	$2.30.10^{10}$	$2.97.10^{10}$	$2.64.10^{10}$	$3.31.10^{10}$	$2.24.10^{10}$
^{134}Cs	$4.27.10^{4}$	$6.98.10^{4}$	$7.99.10^{4}$	$1.60.10^{5}$	$6.04.10^{5}$	$3.60.10^{5}$	$2.74.10^{5}$
^{137}Cs	$4.86.10^{4}$	$6.95.10^{4}$	$9.35.10^{4}$	$1.37.10^{5}$	$6.16.10^{5}$	$4.51.10^{5}$	$4.07.10^{5}$
Total	$1.90.10^{13}$	$3.47.10^{13}$	$3.46.10^{12}$	$8.24.10^{12}$	$9.88.10^{12}$	$1.30.10^{13}$	$9.20.10^{12}$
In this: NG	$1.88.10^{13}$	$3.41.10^{13}$	$1.75.10^{12}$	$5.70.10^{12}$	$7.70.10^{12}$	$8.81.10^{12}$	$7.35.10^{12}$

Note: NG = noble gases

[1] The discharges were negligible in 2000 and 2001 and the data are not included. Physical start-up of Unit 1 was commenced in November 2000, and on 20 December 2001 the State Office for Nuclear Safety issued a licence permitting the reactor power to be increased to its 90% level.

Table C.2.20: Total liquid discharge activity of selected radionuclides from NPP Temelín, 2002-2008

Nuclide	A [Bq]						
	2002	2003	2004	2005	2006	2007	2008
^{3}H	$1.19.10^{13}$	$2.51.10^{13}$	$2.30.10^{13}$	$2.96.10^{13}$	$3.73.10^{13}$	$2.85.10^{13}$	$5.43.10^{13}$
^{137}Cs	$3.95.10^{5}$	$8.82.10^{6}$	$2.56.10^{7}$	$1.02.10^{8}$	$8.20.10^{7}$	$5.15.10^{7}$	$1.32.10^{8}$
^{134}Cs		$6.00.10^{6}$	$1.39.10^{7}$	$1.09.10^{8}$	$8.23.10^{7}$	$5.27.10^{7}$	$1.19.10^{8}$
^{60}Co	$6.75.10^{5}$	$2.15.10^{6}$	$1.23.10^{7}$	$1.18.10^{7}$	$2.20.10^{6}$	$8.75.10^{6}$	$1.33.10^{6}$
^{110m}Ag	$2.07.10^{6}$	$1.44.10^{7}$	$3.22.10^{7}$	$1.22.10^{7}$	$6.88.10^{6}$	$1.87.10^{7}$	$1.69.10^{7}$
^{54}Mn	$4.14.10^{6}$	$2.84.10^{7}$	$4.99.10^{7}$	$2.65.10^{7}$	$6.78.10^{6}$	$6.91.10^{6}$	$3.81.10^{6}$
^{131}I		$1.17.10^{7}$	$2.12.10^{6}$	$1.55.10^{7}$	$1.76.10^{7}$	$2.75.10^{6}$	$2.26.10^{6}$
^{95}Nb	$1.10.10^{7}$	$4.57.10^{7}$	$5.55.10^{7}$		$9.17.10^{6}$	$1.86.10^{7}$	$7.63.10^{6}$
^{58}Co	$8.06.10^{5}$	$1.20.10^{7}$	$1.84.10^{7}$	$9.37.10^{6}$	$9.04.10^{5}$	$1.52.10^{6}$	$2.61.10^{5}$
^{95}Zr	$3.59.10^{6}$	$2.37.10^{7}$	$2.56.10^{7}$	$1.74.10^{7}$	$1.67.10^{6}$	$7.53.10^{6}$	
^{124}Sb	$7.70.10^{7}$	$6.15.10^{7}$	$8.39.10^{7}$		$3.73.10^{7}$		
^{133}I					$1.13.10^{6}$		
^{42}K	$3.82.10^{7}$	$5.67.10^{7}$	$3.55.10^{7}$				
^{24}Na	$2.42.10^{6}$	$1.87.10^{7}$	$3.72.10^{6}$				
^{97}Zr		$2.68.10^{5}$	$9.08.10^{5}$				
^{97}Nb			$2,36.10^{7}$				
^{113}Sn		$5.00.10^{5}$	$8.26.10^{5}$				
^{106}Ru		$1.42.10^{6}$					
^{59}Fe		$1.58.10^{6}$					
^{99}Mo	$1.31.10^{5}$	$1.16.10^{6}$					
^{65}Zn		$3.49.10^{5}$					
^{111}Ag		$5.96.10^{5}$					
Total	$1.19.10^{13}$	$2.51.10^{13}$	$2.30.10^{13}$	$2.96.10^{13}$	$3.73.10^{13}$	$2.85.10^{13}$	$5.43.10^{13}$

The maximum amounts of radionuclides in Temelín discharges into the air and into watercourses are defined by the applicable authorised limits. Temelín's authorised limits for discharges into the air and into watercourses are 40 μSv and 3 μSv, respectively, as set by the State Office for Nuclear Safety Decisions no. 28718/2007 and 26161/2009, respectively.

The table below contains data of total effective doses (from internal and external irradiation) to an individual from the critical subpopulation, calculated by the RDETE code, i.e. taking into account the exposure pathways using actual (hydro)meteorological data for the given year.

Table C.2.21: Committed effective doses E [μSv] corresponding to the annual discharges from NPP Temelín into the air and into watercourses, estimated by the RDETE code

	E [μSv]						
	2002	2003	2004	2005	2006	2007	2008
Air	0.118	0.273	0.217	0.186	0.053	0.050	0.030
Watercourses	0.082	0.159	0.184	0.228	0.396	0.302	0.584

In the annual reports, the critical subpopulation is identified with that subpopulation for which the calculation has provided the highest effective dose from external irradiation and from the intake of radionuclides that year. The hypothetical critical subpopulation thus can be different in different years, depending on the actual (hydro)meteorological situation and actual discharges.

Balance measurements of radioactive substances in the discharges confirm that during the period in question, the annual discharges into air and into watercourses were below 0.25% and 20% of the authorised limits, respectively.

Monitoring of the surroundings

The activities of man-made radionuclides in the compartments of the environment in the surroundings of NPP Temelín are at or below the limits of detection, although the measuring techniques are very sensitive. In other words, the contribution of the discharges to radioactivity in the plant surroundings is negligible. ^{137}Cs, which has been detected in some environmental and food chain samples, comes from global fallout and lies within the levels observed at other sites of the Czech Republic.

As to external irradiation, the (photon) dose equivalent rates are at the natural background level. No impacts of the NPP operation have been recorded. By way of example, the 2008 results obtained by the local TLD network operated by Temelín's Laboratory for Radiation Monitoring of the Surroundings (LRKO) are presented in the table below.

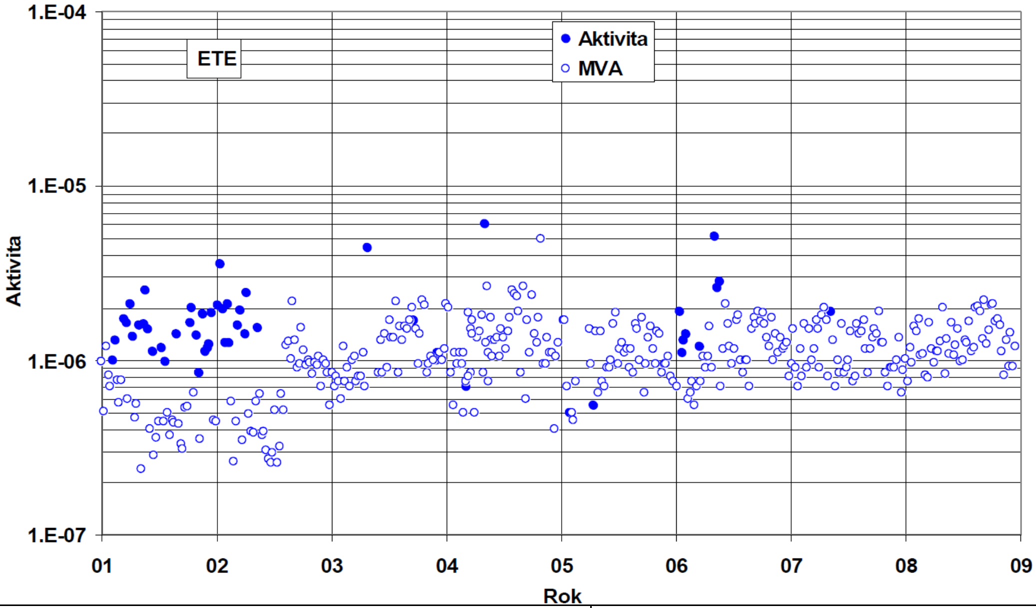
Table C.2.22: Mean quarterly photon dose equivalent rates measured by the local TLD network in the surroundings of the Temelín NPP, 2008 (measurements by the Temelín LRKO)

Measuring site	I/08	II/08	III/08	IV/08	Mean
	[nSv/hr]				
Býšov - ČEZ premises	118	107	107	119	113
Býšov - Strouha gamekeeper's lodge	118	114	112	124	117
Coufalka	128	110	123	124	121
Coufalka - gamekeeper's lodge	130	112	123	127	123
České Budějovice	142	124	129	139	134
Červený Vrch	134	116	117	133	125
Dříteň - building no. 116	135	109	105	116	116
Hněvkovice - ISOŠ	125	107	111	120	116
Hněvkovice - dam	137	115	123	126	125
Hůrka - Soil remediation	125	111	117	125	120
Kočín, building no. 8	134	112	122	121	122
Lhota pod Horami - building no. 27	145	140	133	136	139
Lhota pod Horami - cow-shed	126	123	114	138	125
Lhota pod Horami - gas station	135	116	115	146	128
Litoradlice, building no. 10	123	110	113	129	119
Malešice - building no. 36	127	115	115	128	121
Malešice - farm	117	101	108	113	110
Neznašov	168	145	151	159	156
Nová Ves	135	117	128	128	127
Pláňovy, building no. 38	160	140	146	153	150
Předhájek - Všemyslice, building no. 36	169	147	153	160	157
SRKO Bohunice	119	107	108	120	114
SRKO ČEZ-ETE	126	109	114	124	118
SRKO Litoradlice	132	120	124	140	129
SRKO Nová Ves	143	121	128	132	131
SRKO Sedlec	114	108	106	123	113
SRKO Zvěrkovice	128	112	117	119	119
Strachovice - transformer station	137	129	122	144	133
Temelín - meteostation	132	126	126	142	132
Temelín - health centre	156	145	140	161	151
Týn nad Vltavou - kindergarten	132	116	123	129	125
Týn nad Vltavou - water treatment plant	134	117	118	128	124
U Palečků	127	107	121	122	119
Všemyslice - building no. 33	126	114	113	126	120
Záluží	135	116	115	121	122

The NPP Temelín surroundings are also monitored by using field gamma spectrometry. The specific activity of man-made radionuclides and natural radionuclides is measured. From among man-made radionuclides, only ^{137}Cs (arising from the Chernobyl fallout) is measured in cultivated and uncultivated soil. All the other man-made radionuclides are below the minimum detectable activity. No impacts of the NPP operation were recorded.

At the 7 sampling sites of the local plant network, radioactivity in air is determined in weekly samples by gamma spectrometry. Reports include ^{137}Cs only because this is the only man-made radionuclide which is present at measurable levels. The activity of cosmogenic ^{7}Be is also measured as a means of accuracy control. A pooled sample from all sites of the NPP surrounding plus the plant area is measured. The results for ^{137}Cs are illustrated by the graph which is reproduced below. No impacts of the NPP operation have been recorded.

Figure C.2.48: Specific radioactivity [Bq/m³] of ^{137}Cs in aerosols as recorded by the local air contamination monitoring network (7 sampling sites) in the surrounding area of NPP Temelín

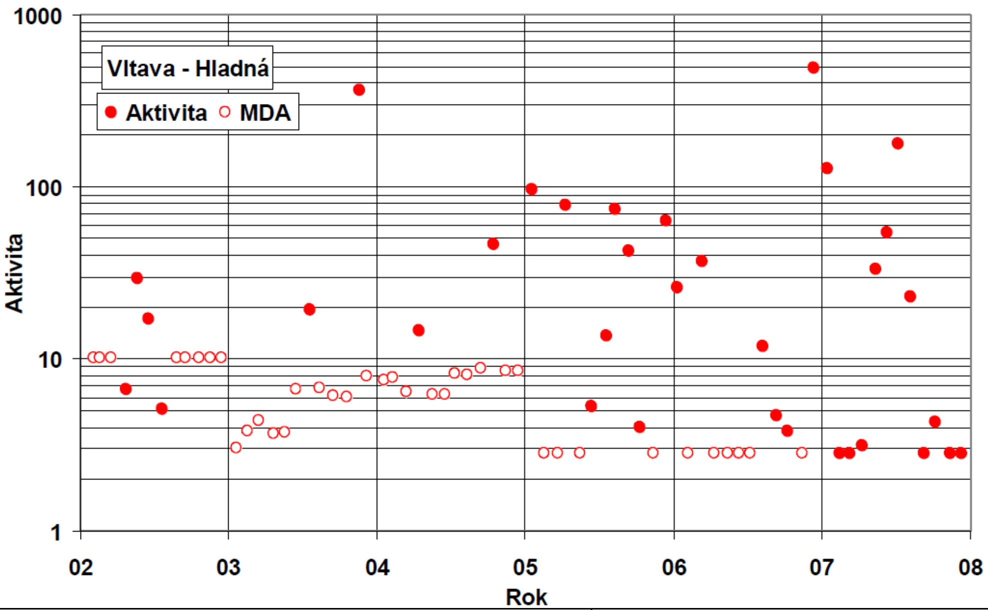


Aktivita	Activity
Rok	Year
MVA	MSA
ETE	Temelín PP

Fallout in the plant surroundings in normal radiological conditions is evaluated in monthly intervals. Gamma spectrometry is used as the analytical method. For the same reasons as for aerosols, only ^{137}Cs and ^{7}Be are measured in the fallout. No impacts of the NPP operation have been recorded.

Balancing of the discharges into watercourses is the plant operator's responsibility, accomplished by radionuclide measurement in each control tank prior to draining it into the wastewater collection sump and subsequently into the buried Kořensko reservoir. Activity of water in the collection sumps is monitored constantly. The correctness of the balance of discharges into watercourses is borne out by surface water sample measurements at specific times and sites and in precipitation in accordance with the approved monitoring programme. The graph below shows the time development (2002-2007) of ^{3}H in the Vltava at Hladná. The limit for tritium in surface water laid down in the licence issued by the water management authority was never exceeded.

Figure C.2.49: Specific activity [Bq/l] of ^{3}H in the Vltava River at Hladná (data by the plant operator)



Aktivita	Activity
Rok	Year

The tables below present results of environmental and food chain monitoring over a longer period of time, i.e. 1998 to 2008 and in 2008. The data demonstrate that the operation of the NPP has had no impact on the basic compartments of the environment or on the food chains: the differences in the activities of the various commodities between the situation prior to and after starting up the plant are statistically insignificant.

Table C.2.23: ^{137}Cs activity in samples taken within the Temelín plant area and in its surrounding: weekly aerosols [Bq/m^{3}], monthly fallout [Bq/m^{2}], selected components (i) of the environment: soil [Bq/kg], and (ii) of the food chain: water, milk [Bq/l], cereals, fish [Bq/kg]. (Sampling and measurement: Laboratory for Radiation Monitoring of the NPP Temelín surroundings)

Component		Aerosols 1)	Fallout	Soil 2)	Drinking water	Milk	Cereals 2) 3)	Fish (meat)
^{137}Cs activity	1998	6.8.10^{-6}	1.0 *)	5.4.10^{2} *)	< 2.2.10^{-3}	2.0.10^{-1} *)	3.2.10^{-1}	3.5
	1999	3.4.10^{-6} *)	< 2.5.10^{-1}	5.8.10^{2} *)	<2.3.10^{-3}	1.5.10^{-1} *)	1.8.10^{-1}	2.6
	2000	5.0.10^{-6} *)	2.9.10^{-1}	1.5.10^{3} *)	< 1.8.10^{-3}	1.8.10^{-1} *)	< 1.1.10^{-1}	2.7
	2001	< 3.0.10^{-6}	< 4.0.10^{-1}	1.3.10^{3} *)	< 2.1.10^{-3}	1.6.10^{-1} *)	< 7.2.10^{-2}	2.7
	2002	6.6.10^{-6} *)	< 2.6.10^{-1}	1.4.10^{3} *)	< 2.0.10^{-3}	4.9.10^{-1} *)	< 2.1.10^{-1}	2.7
	2003	6.0.10^{-6} *)	< 1.4.10^{-1}	1.8.10^{2} *)	< 3.0.10^{-3}	< 1.7.10^{-1}	< 2.2.10^{-1}	1.3
	2004	< 9.9.10^{-6}	< 1.2.10^{-1}	5.8.10^{2} *)	< 4.0.10^{-3}	< 1.6.10^{-1}	< 1.7.10^{-1}	1.3
	2005	1.40.10^{-6}	< 1.2.10^{-1}	1.9.10^{2} *)	< 1.3.10^{-2}	< 1.3.10^{-1}	< 1.7.10^{-1}	4.9
	2006	5.10.10^{-6}	< 3.8.10^{-1}	1.6.10^{2} *)	< 1.5.10^{-2}	< 1.3.10^{-1}	< 1.4.10^{-1}	6.2
	2007	< 4.0.10^{-6}	< 3.1.10^{-1}	1.7.10^{2} *)	< 1.3.10^{-2}	< 1.8.10^{-1}	< 2.0.10^{-1}	1.2
	2008	< 4.4.10^{-6}	< 3.0.10^{-1}	1.3.10^{2} *)	< 1.5.10^{-2}	< 1.4.10^{-1}	< 1.6.10^{-1}	1.2

Notes.:
1) Mixed samples from various sites near and within the plant area
2) Relative to dry weight
3) This commodity includes mixed samples of various cereals from different sites near the plant
4) Data marked with an asterisk *) correspond to the upper limit of the 95% tolerance interval (i.e. interval within which 95% of the values of the quantity in question are expected); non-flagged data denote the maximum activity observed; data with the "<" sign denote activities below that level (MDA) at the 95% confidence level

Table C.2.24: Specific activity of radionuclides in aerosols [Bq/m^{3}], fallout [Bq/m^{2}], and components of the environment and food chains [Bq/kg, Bq/l] in the Temelín plant surroundings, 2008 (sampling and measurement: LRKO; taken over from a NPP Temelín report)

Component	Mean value	95% tolerance interval	Number of measurements	In this: > MDA
^{137}Cs				
Aerosols 1)	-	< 4.4.10^{-6} *	52	0
Fallout	-	< 3.0.10^{-1} *	24	0

Soil [2)]	$2.4.10^{1}$	$3.4 - 1.3.10^{2}$	8	8
Surface water	-	$< 1.5.10^{-2}$*	20	0
Drinking water	-	$< 1.5.10^{-2}$*	8	0
Ground water	-	$< 1.5.10^{-2}$*	15	0
Milk	-	$< 1.4.10^{-1}$*	26	0
Cereals [2) 3)]	-	$< 1.6.10^{-1}$*	2	0
Apples [1) 2)]	-	$< 3.9.10^{-1}$	1	0
Forest fruits [1) 2)]	-	1.7	1	1
Fish (meat)	-	$4.1.10^{-1} - 1.2$*	4	4
Animal feed [2) 3)]	-	$3.4 - 6.0$*	2	2
Sediments – waste duct [2) 6)]	-	$2.3.10^{1}$	1	1
Other sediments [2)]	-	$1.3.10^{1}$	1	1
^{90}Sr				
Surface water	-	$< 4.6.10^{-2}$*	3	0
Milk [1)]	-	$< 1.9.10^{-2}$	1	0
^{3}H				
Surface water [4)]	$3.6.10^{1}$	$3.3.10^{-1} - 7.9.10^{2}$	32	19
Surface water [5)]	-	$< 2.7 - 4.9$*	12	2
Groundwater - monitoring boreholes, plant surroundings	-	< 3.2*	15	0
Groundwater - wells, plant surroundings	-	< 3.2*	6	0
Groundwater - monitoring drills, plant area	-	$< 2.7 - 4.1$*	17	2
Groundwater - draining drills, plant area	-	$< 2.7 - 2.0.10^{1}$	36	15
Drinking water	-	< 3.2 *	30	0

Notes:

1) Mixed sample
2) Relative to dry weight
3) This commodity includes the specified number of mixed samples
4) Surface water affected by NPP discharges
5) Surface water not affected by NPP discharges
6) Sediments are taken from the surface water sampling sites approximately 2 km and 35 km downstream of the wastewater duct mouth
* Due to the properties of the data set, the range was used as the parameter describing the set.
MDA = minimum detectable activity

C.2.3.3.2.3. Independent monitoring of the Temelín plant

Apart from the independent territorial monitoring, discharges into waters and into air and the NPP surroundings are subject to independent monitoring as stipulated by Czech legislation and in accordance with Article 35 (Section 3) of the EURATOM Treaty.

Independent monitoring of discharges

Within the process of independent monitoring of aerosols in the discharges, the Laboratory of Radiation Monitoring of the Plant Surroundings (LRKO) measures the aerosol filter and sends a piece of the filter to the National Radiation Protection Institute (SÚRO) in Prague, where combined quarterly (monthly since 2008) samples are analysed for radionuclides by gamma spectrometry and combined 6-month samples are analysed for transuranium radionuclides and ^{90}Sr. By way of example, an overview of the total annual activities of radionuclides in aerosol discharges from the NPP Temelín in 2008 is presented in the tables below. The specific activities are largely very low, particularly in the internal ventilation stacks.

Table C.2.25: Overview of annual atmospheric discharges of gamma-emitting aerosols, 2008 (sampling: LRKO, measurement: SÚRO)

Ventilation stack	Internal HVB-1	External HVB-1	Internal HVB-2	External HVB-2	BAPP
Nuclide	[kBq]				
^{51}Cr	19	19	32	210	160
^{54}Mn	0.49	96	0.70	28	60
^{57}Co	0.46	0.52	0.58	0.44	8.9
^{58}Co	0.96	22	1.5	58	42
^{60}Co	0.62	40	0.85	16	54
^{59}Fe	2.7	29	4.4	9.5	27
^{65}Zn	1.5	20	1.9	1.6	10
^{75}Se	0.83	0.76	1.1	2.8	3.8
^{95}Zr	1.9	83	2.7	560	22

^{95}Nb	2.00	320	3.2	2000	86
^{103}Ru	1.5	2.0	2.3	1.9	9.8
^{110m}Ag	26	220	18	280	300
^{113}Sn	0.98	0.97	1.4	15	12
^{124}Sb	1.2	27	1.9	110	890
^{125}Sb	1.4	47	2.1	40	1,900
^{134}Cs	3.7	23	13	1.1	45
^{137}Cs	2.0	34	13	54	73
^{141}Ce	2.6	2.5	3.9	1.7	15
^{144}Ce	3.7	4.2	4.6	21	21
^{181}Hf	2.7	2.2	4.3	2.3	18

Table C.2.26: Activities of ^{90}Sr and transuranium elements in atmospheric discharges from NPP Temelín, 2008 (sampling: LRKO, measurement: SÚRO)

Object	Months	Ventilation stack *)	Activity [Bq]					
			^{90}Sr	^{238}Pu	$^{239.240}$Pu	^{241}Am	^{242}Cm	$^{243.244}$Cm
HVB-1	1	Internal	< 130	24.4	8.1	94	< 19.5	< 3.2
		External	< 140	< 5.9	< 3.6	< 13.8	< 18.5	7.0
	2	Internal	< 190	< 2.1	< 2.5	14.2	< 3.8	< 1.7
		External	< 440	< 7.8	< 5.9	23	110	< 5.9
	Total		< 900	<24.4; 40.2>	<8.1; 20.1>	<131.2; 145>	<110; 151.8>	<7; 17.8>
HVB-2	1	Internal	220	< 5.7	< 6.6	23	< 13.9	< 6.6
		External	< 110	25.7	< 2.3	14.3	107	9.5
	2	Internal	< 170	< 3.3	< 2.3	15	< 4.7	< 1.4
		External	-	-	-	-	-	-
	Total		<220; 500>	<25.7; 34.7>	< 11.2	52.3	<107; 125.6>	<9.5; 17.5>
BAPP	1		< 1200	< 17.8	330	103	< 60	< 27
	2		< 660	< 9.5	< 9.5	59	< 11.2	< 9.5
	Total		< 1860	< 27.3	<330; 339.5>	162	< 71.2	< 36.5

Note:

*) The internal ventilation stack is constantly operable, whereas the external ventilation stack is only operated during nuclear reactor outage
The “<” symbol denotes the minimum significant activity at the 95% confidence level
Levels between the “<” and “>” symbols in the Total line define the interval within which the activity actually released into the air lies

In the table below, a comparison is made between the radioactivities of selected nuclides and plant operator's data for the external HVB-1 ventilation stack (the radioactivities are largely considerably lower in the internal ventilation stacks).

Table C.2.27: Independent monitoring (SÚRO) of specific activities [Bq/m^3] of selected radionuclides in aerosol discharges in comparison with the levels measured by the NPP Temelín operator: external HVB-1 ventilation stack

		SÚRO		NPP Temelín	
Nuclide	Year	A	σ	A	σ
^{60}Co	2005	$1.5.10^{-4}$	$3.91.10^{-5}$	$2.4.10^{-4}$	$5.08.10^{-5}$
	2006	$1.2.10^{-4}$	$3.11.10^{-5}$	$8.3.10^{-5}$	$1.74.10^{-5}$
	2007	$2.5.10^{-4}$	$6.50.10^{-5}$	$1.0.10^{-4}$	$2.10.10^{-5}$
	2008	$1.4.10^{-4}$	$3.65.10^{-5}$	$1.5.10^{-4}$	$3.21.10^{-5}$
^{134}Cs	2005	$1.5.10^{-5}$	$3.81.10^{-6}$	$2.5.10^{-5}$	$5.22.10^{-6}$
	2006	$1.2.10^{-4}$	$3.11.10^{-5}$	$9.5.10^{-5}$	$1.99.10^{-5}$
	2007	$1.5.10^{-4}$	$3.87.10^{-5}$	$1.8.10^{-4}$	$3.80.10^{-5}$
	2008	$3.3.10^{-4}$	$8.69.10^{-5}$	$3.9.10^{-4}$	$8.21.10^{-5}$
^{137}Cs	2005	$4.4.10^{-5}$	$1.14.10^{-5}$	$4.2.10^{-5}$	$8.92.10^{-6}$
	2006	$1.5.10^{-4}$	$4.01.10^{-5}$	$1.4.10^{-4}$	$3.00.10^{-5}$
	2007	$2.1.10^{-4}$	$5.58.10^{-5}$	$2.3.10^{-4}$	$4.91.10^{-5}$
	2008	$5.8.10^{-4}$	$1.52.10^{-4}$	$5.7.10^{-4}$	$1.19.10^{-4}$

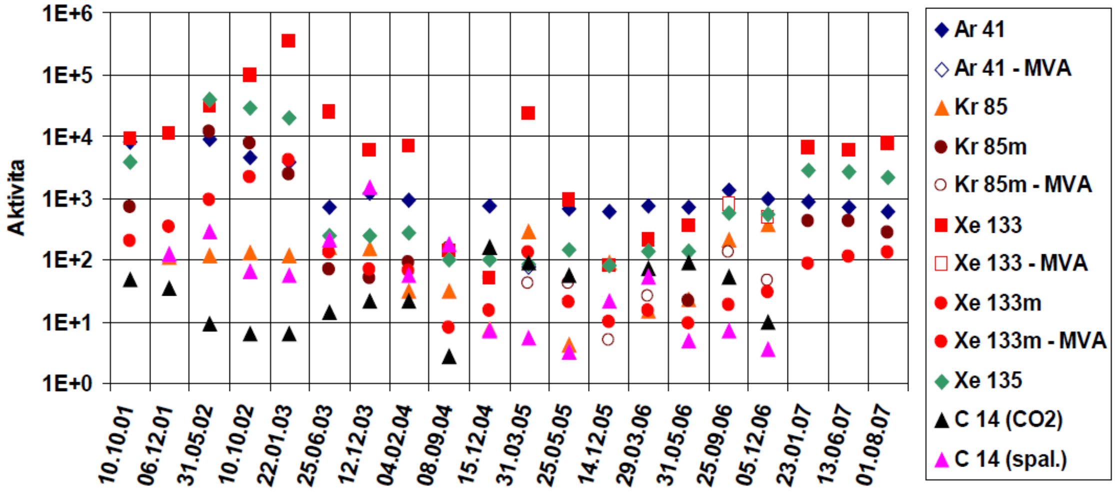
Notes:

A = average specific activity level, Bq/m^3
σ = standard deviation, Bq/m^3

Comparison of other radionuclides and comparison of discharges from other ventilation stacks provide similar results. It can be concluded that the activities of aerosol discharges measured by the plant operator and by an independent body are consistent within the limits of uncertainty.

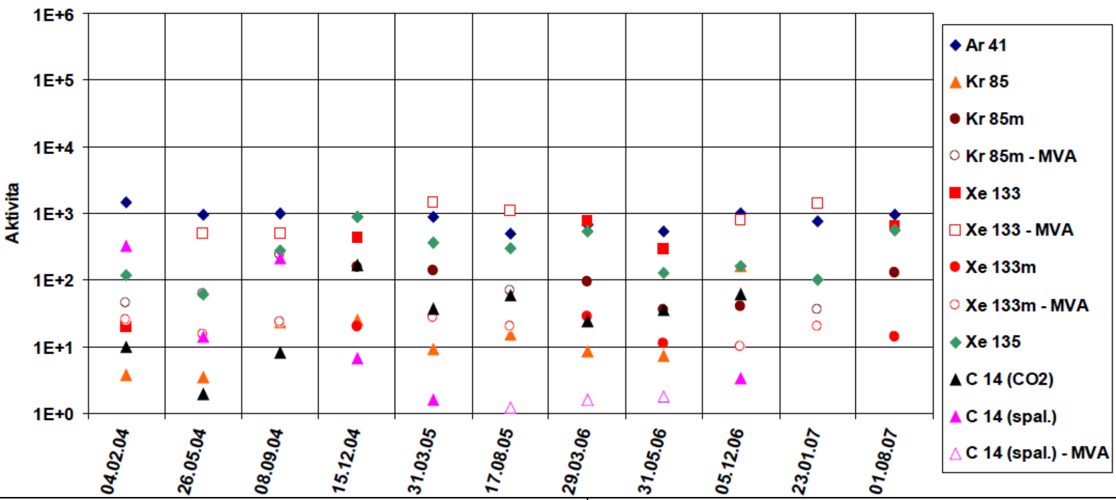
Current independent monitoring also covers noble gases and ^{14}C. The results are presented in the graphs below. Overall, it can be concluded that the data from the independent monitoring of atmospheric discharges and the data measured by the plant operator are mutually consistent.

Figure C.2.50: Specific activities [Bq/m^3] of noble gases in the internal HVB-1 ventilation stack (sampling: NPP, measurement and evaluation: SÚRO)



Aktivita	Activity
MVA	MSA
C14 (CO2)	C14 (CO2)
C14 (spal.)	C14 (fumes)

Figure C.2.51: Specific activities [Bq/m^3] of noble gases in the internal HVB-2 ventilation stack (sampling: NPP, measurement and evaluation: SÚRO)



Aktivita	Activity
MVA	MSA
C14 (CO2)	C14 (CO2)
C14 (spal.)	C14 (fumes)

Independent monitoring of the surroundings

By way of example, the results of independent monitoring (2008) of external irradiation by the local TLD network falling under the authority of the State Office for Nuclear Safety (SÚJB) are presented in the table below.

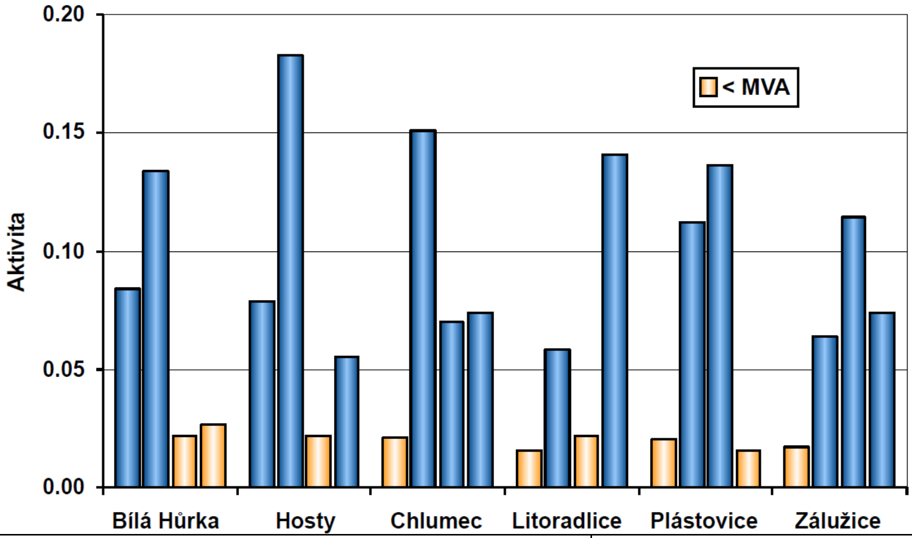
Table C.2.28: Mean quarterly photon dose equivalent rates measured by the local TLD network in the surroundings of NPP Temelín, 2008 (measurement: SÚRO, transport of the dosimeters from/to the measuring sites: České Budějovice Regional Centre)

Measuring site	I/08	II/08	III/08	IV/08	Mean
	[nSv/hr]				
Dívčice	136	139	135	144	139
Litoradlice	109	101	106	100	104
Mydlovary	122	125	128		125
Protivín	140	137	146	132	139
Radnice	110	114	115	107	112
Ševětín	138	135	139	138	138
Týn nad Vltavou	122	116	127	110	119
Bosňany	133	127	136		132
Zliv	126	136	120	124	127

Note: Where no result is given, the dosimeter was stolen or damaged

Aerosols in the near vicinity to the NPP are not sampled within the independent monitoring exercise. In fact, the independent monitoring of atmospheric discharges (migration models applied to the discharges demonstrate that the actual activities in the plant surroundings lie below the presented limits of detection) and the monitoring of fallout are considered to be a sufficient evidence of the correctness of the levels reported by the plant operator. The 2008 levels of specific activity of ^{137}Cs in fallout in the NPP surroundings, at the various sites monitored by the SÚJB Regional centres, are shown in the graph below.

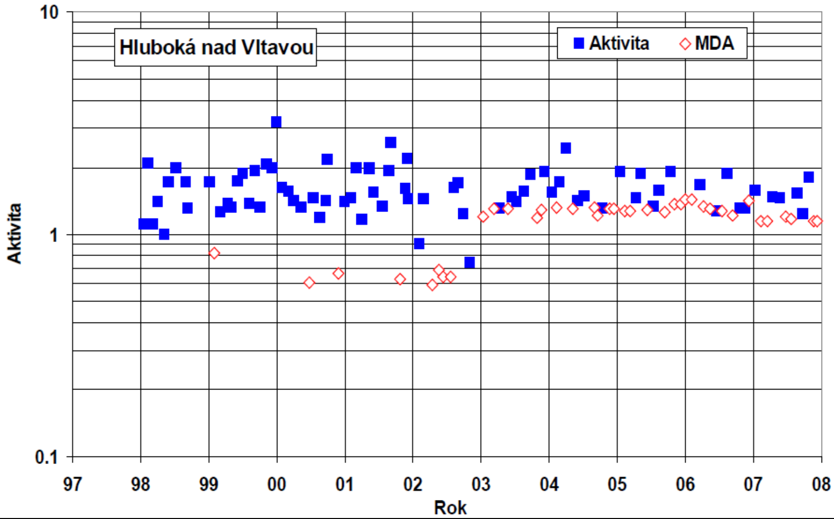
Figure C.2.52: Specific activities [Bq/m^2] of ^{137}Cs in fallout in the surroundings of the NPP, 2008 – quarterly values at the various sites (sampling and measurement: SÚJB Regional Centre in České Budějovice)



Aktivita	Activity

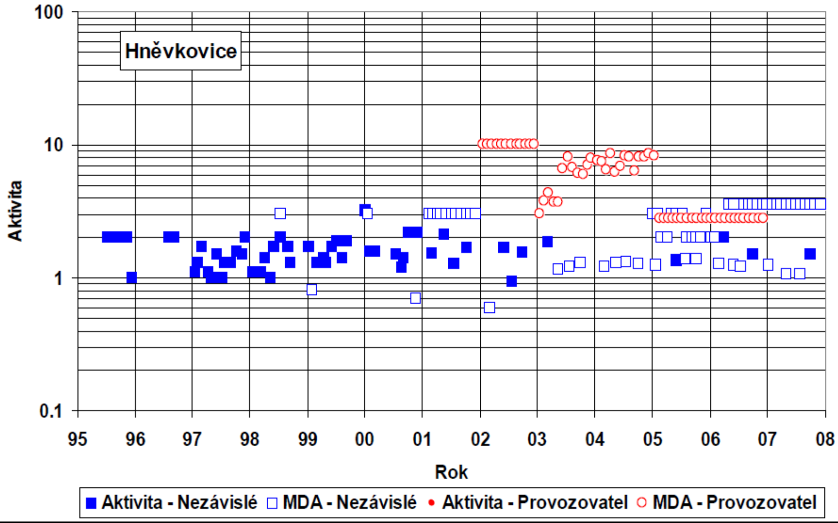
Pre-operational monitoring of tritium levels in surface waters, for which a potential impact of the operation of NPP Temelín (then under construction) was considered conceivable, was started in 1991 with a view to ascertaining the long-term trend of the background and its fluctuations prior to the start of the NPP. The data for tritium in the Vltava (or Labe) River, retrieved from the SÚJB/SÚRO, ČHMÚ and VÚV databases, are shown in the following graphs (the results measured by the plant operator at Hněvkovice are also shown for comparison).

Figure C.2.53: Specific activity [Bq/l] of ^{3}H in the Vltava River at Hluboká nad Vltavou



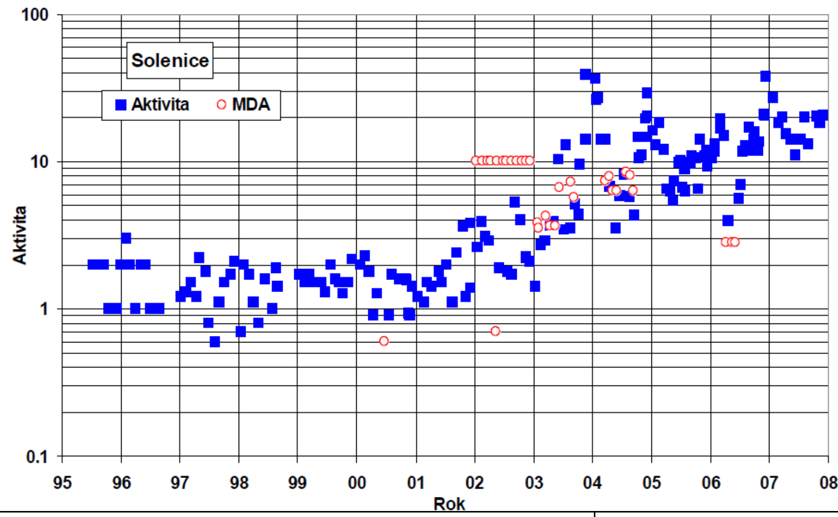
Aktivita	Activity
Rok	Year
MDA	Minimum Detectible Activity (MDA)

Figure C.2.54: Specific activity [Bq/l] of ^{3}H in the Vltava River at Hněvkovice



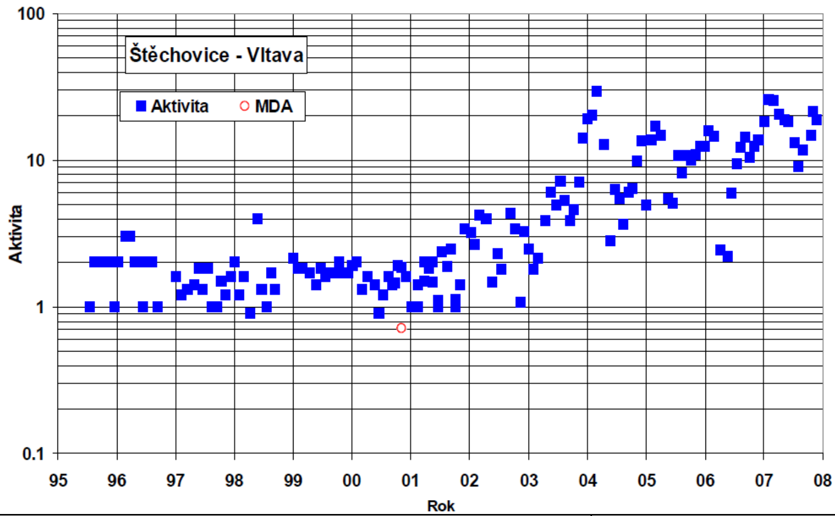
Aktivita	Activity
Rok	Year
Nezávislé	Independent
MDA - Nezávislé	MDA – Independent
Aktivita - Provozovatel	Activity - Operator
MDA - Provozovatel	MDA - Operator

Figure C.2.55: Specific activity [Bq/l] of ^{3}H in the Vltava River at Solenice



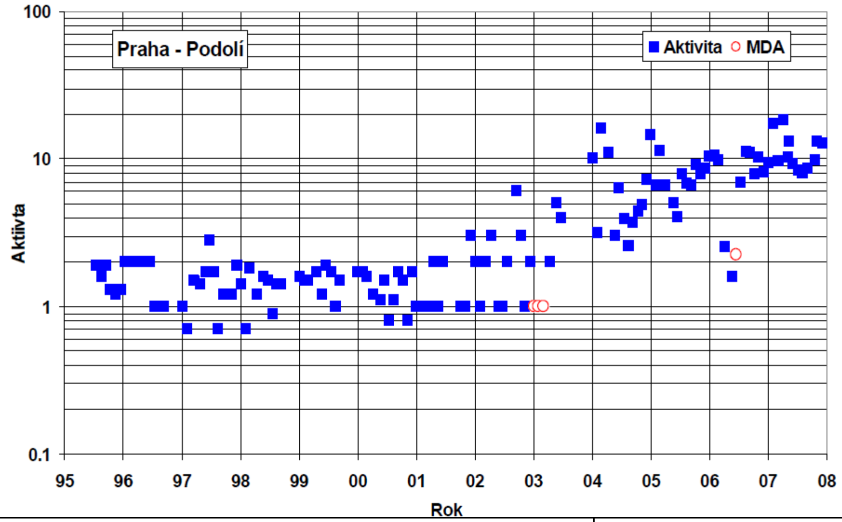
Aktivita	Activity
Rok	Year
MDA	Minimum Detectible Activity (MDA)

Figure C.2.56: Specific activity [Bq/l] of ^{3}H in the Vltava River at Štěchovice



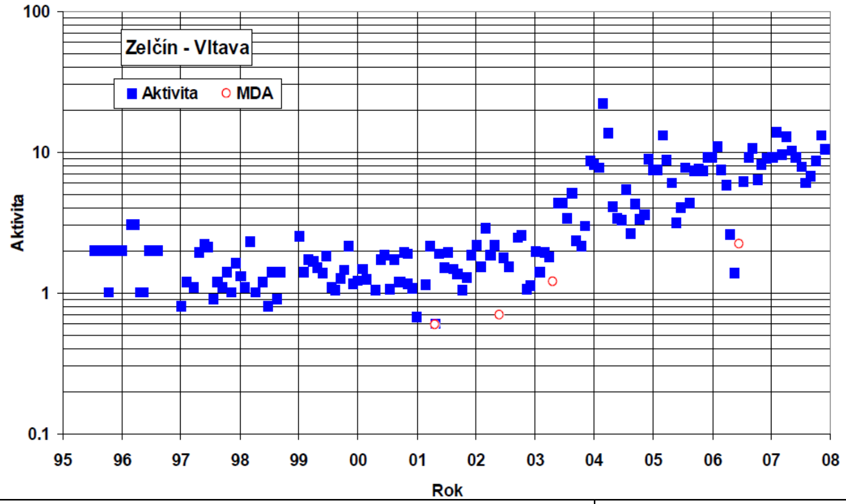
Aktivita	Activity
Rok	Year
MDA	Minimum Detectible Activity (MDA)

Figure C.2.57: Specific activity [Bq/l] of ^{3}H in the Vltava River in Prague - Podolí



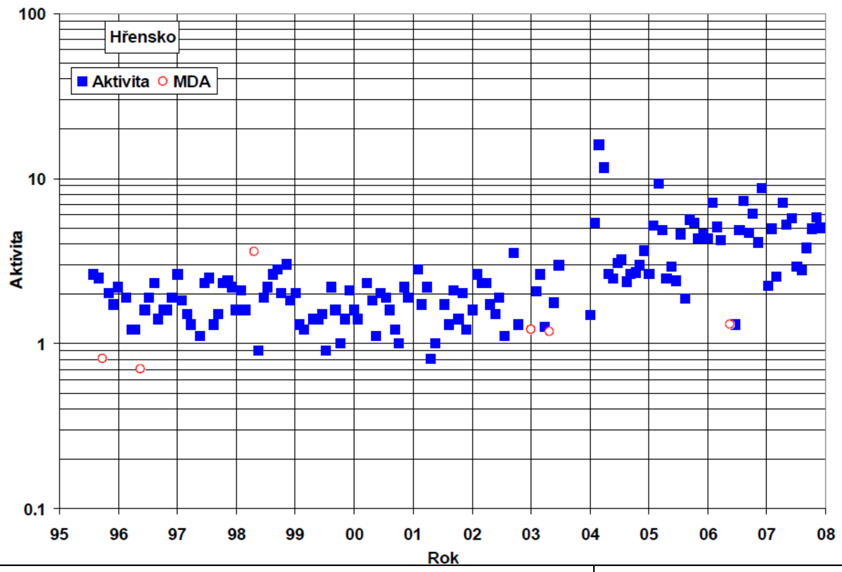
Aktivita	Activity
Rok	Year
MDA	Minimum Detectible Activity (MDA)

Figure C.2.58: Specific activity [Bq/l] of ^{3}H in the Vltava River at Zelčín



Aktivita	Activity
Rok	Year
MDA	Minimum Detectible Activity (MDA)

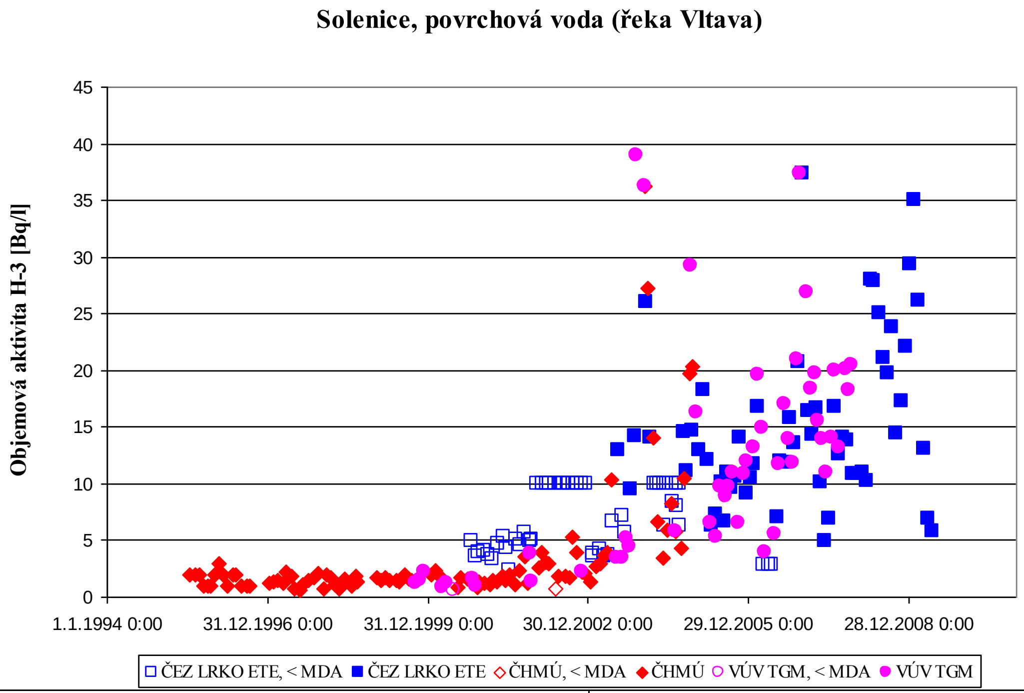
Figure C.2.59: Specific activity [Bq/l] of ^{3}H in the Labe River at Hřensko



Aktivita	Activity
Rok	Year
MDA	Minimum Detectible Activity (MDA)

For comparison, the graph below shows specific activities of ^{3}H in the Vltava at Solenice, 1996-2009, measured by the plant operator (ČEZ a.s.) through the Laboratory of Radiation Monitoring of the NPP Temelín Surroundings (LRKO ETE) and by the Czech Hydrometeorological Institute (ČHMÚ) and Masaryk Water Research Institute (VÚV TGM).

Figure C.2.60: Specific activity of ^{3}H in the Vltava River at Solenice, 1995-2009, measured by the Temelín LRKO, ČHMÚ and VÚV TGM



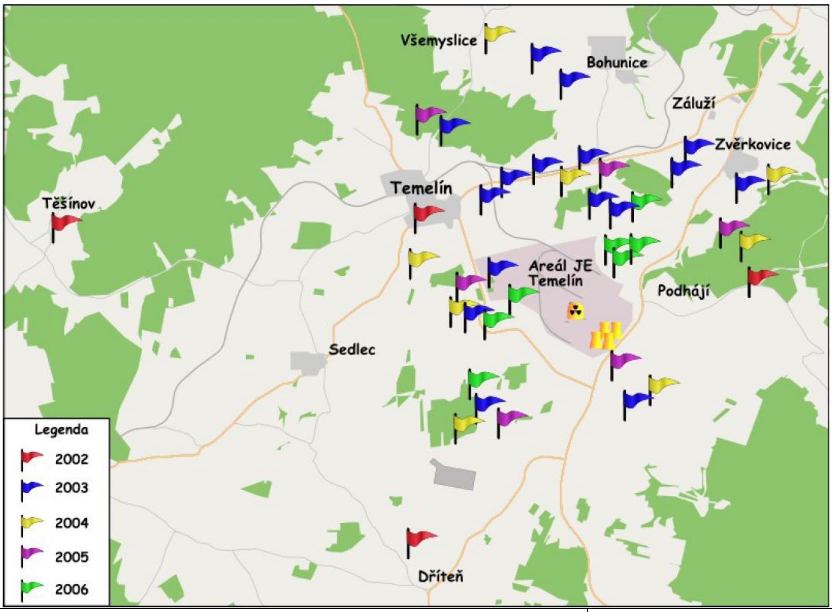
Solenice, povrchová voda (řeka Vltava)	Solenice, surface water (Vltava River)
Objemová aktivita H-3	Volumetric activity H-3
ČEZ LRKO ETE, < MDA	ČEZ Neighbourhood Radiation Control Lab (NRCL) TPP, <

	MDA
ČEZ LRKO ETE	ČEZ NRCL TPP
ČHMÚ, < MDA	CHMI, < MDA
ČHMÚ	CHMI
VÚVTGM, < MDA	TG Masaryk Water Management Research Institute (VÚVTGM), < MDA
VÚVTGM	VÚVTGM

The graphs indicate that the specific activities of ^{3}H in rivers affected by discharges from NPP Temelín are several orders of magnitude below the surface water contamination limits laid down by the Czech Republic Government Decree no. 82/1999, Annexe 3 III. - not only 5,000 Bq/l for other surface waters but also 700 Bq/l for water management-relevant watercourses.

Carbon ^{14}C in the biota is also monitored near NPP Temelín. This radionuclide contributes most to the effective dose population ín the surroundings of NPPs with PWR reactors during normal operation, and is measurable. It should be stressed, though, that although dominant, the committed effective dose to an individual in the Temelín plant surroundings is very low. The ^{14}C activity level in air and in the biota is mainly determined by cosmogenic production of this radionuclide, its build-up from nuclear weapon tests, current ^{14}C contributions from nuclear power installations (anthropogenic effect) and dilution of ^{14}C in the isotopic carbon mixture by fossil carbon from the combustion of fossil fuels (the Suess effect; an appreciable decrease in activity is observed in regions with a high burden from the firing of fossil fuels). The locations of the sampling sites for taking samples of the biota are shown in the map below.

Figure C.2.61: Map of vegetation sampling sites in the vicinity of NPP Temelín, 2002-2005



Areál JE Temelím	NPP Temelín complex
Legenda	Legend

The ^{14}C levels in the biota were compared to those from reference sites with low and high burdens from fossil fuel firing (if unburdened by discharges, the Temelín plant surroundings would apparently fall somewhere between the two reference types). The results in the form of the basic statistical indicators for 2002 to 2005 are presented in the following table (results from the surroundings of NPP Dukovany are included for comparison). The observed ^{14}C activities in the biota of the NPP Temelín nearby surroundings do not deviate appreciably from the range of levels for natural fluctuations of this radionuclide in the environment. A statistically significant increase in ^{14}C in the surroundings of the NPP was demonstrable in comparison with the reference regions with a low local burden from the firing of fossil fuels at the 5% significance level and in comparison with the reference regions with a medium (elevated) local burden from the firing of fossil fuels at the 1% significance level. A similar small ^{14}C increase in the biota of the nearby surroundings, statistically demonstrable on a larger set of data only, is typical of the majority of PWR type nuclear power plants.

Table C.2.29: Basic statistical indicators for carbon ^{14}C, 2002-2005 summary data [per mille $\Delta^{14}C$ *]**

	NPP Dukovany	NPP Temelín	Low-burden reference* (A)	Elevated-burden reference** (B)
Arithmetic mean	60.1	61.0	56.2	47.4
Median	58.3	60.4	56.2	45.7
Standard deviation of the sample	13.2	9.0	6.5	7.3
Variation	173	81	42.1	53.5
Number of observations	27	50	21	9
Observed maximum	95.9	84.4	67.9	58.7
Observed minimum	39.8	41.7	44.0	38.0

Notes:

* Region free from significant local sources of fossil CO_2 ("A".)
** Specifically, peripheral parts of the capital Prague ("B".)
*** $\Delta^{14}C$ is the conventional method of expressing ^{14}C activity in per mille (‰) units. Activity of 14C is typically expressed as Δ14C relative to the activity of a conventional radiocarbon standard, the latter being approximately equal to the equilibrium activity of cosmogenic 14C in nature free from anthropogenic effects. The level of 0‰ Δ14C is approximately 0.226 Bq 14C per gram of the isotopic carbon mixture.

Scientists of the Faculty of Nuclear Sciences and Physical Engineering (FJFI), Czech Technical University (ČVUT) in Prague have been performing biomonitoring of atmospheric deposition of man-made radionuclides in the surroundings of NPP Temelín since 2000. About 200 to 250 samples of moss, pine bark, forest humus, forest fruit and chestnut boletus were taken from the plant surroundings each year and the ^{137}Cs present in them were quantified. Furthermore, FJFI scientists measured photon fields at 14 selected monitoring sites near the plant in 2000 (preoperational monitoring), 2002, 2004, and 2006. A total of 588 integral measurements and 56 spectrometric measurements have been performed. It follows from comparison between the dose rates observed during the pre-operational period and during the operational period (till 2006) that the observed rates match typical natural background levels within their local differences, mainly due to the geologic bedrock (soil composition), radon concentration in the soil and air, and other factors. No impact of the existing operation of NPP Temelín on the natural background level has been demonstrated at the monitoring sites. The activities of ^{137}Cs measured in the bioindicators match the pre-operational levels. No other man-made radionuclides were identified in the samples.

The 2008 results of independent monitoring of the environment and food chain components near NPP Temelín are given in the table below. The data approach those reported by the plant operator, as well as those measured in the remaining parts of the Czech Republic.

Table C.2.30: Specific activities of ^{137}Cs in monthly fallout [Bq/m^2], in milk [Bq/l], and in food chain components [Bq/kg], and specific activities of ^3H in waters [Bq/m^3], monitored within the independent monitoring project for the NPP Temelín surroundings, 2008 (sampling and measurement: SÚJB Regional Centre in České Budějovice)

Component	Range *)	Number of measurements	In this: > MVA
	^{137}Cs		
Total fallout	$< 3.2.10^{-2}$ - $< 1.8.10^{-1}$	24	9
Milk	$< 4.8.10^{-2}$ - $1.0.10^{-1}$	4	3
Hay	3.1	1	1
Silage and haylage	$1.4.10^{-1}$ - 1.7	4	3
Fruit	$<9.4.10^{-2}$	7	0
Cereals	$< 6.3.10^{-2}$	4	0
Maize	$< 7.1.10^{-2}$	1	0
Forest fruits	$< 6.6.10^{-2}$ - 5.1	3	1
Mushrooms	$< 1.5.10^{-1}$ - $2.6.10^{1}$	2	1
	^3H		
Surface water 1)	$< 1.5.10^{-1}$ - $4.1.10^{2}$	46	23
Surface water 2)	< 1.5 - $1.1.10^{1}$	23	8
Drinking water 2)	< 1.5	2	0

Notes:

4) Water affected by NPP discharges
5) Water not affected by NPP discharges
* Due to the properties of the set, the range was used as the parameter describing the set. Where the data set includes levels below the MVA, the lowest value in the set is given as the lower limit of the range. Where this level is the MVA, the "<" sign is added. Where all values for the commodity lie below the MVA, the highest MVA is given in the Range column.

MVA and the "<" symbol denote the minimum significant activity at the 95% confidence level.

For comparison, the next table contains an overview of the maximum levels for each commodity, completed with independent monitoring data for NPP Dukovany. The table demonstrates that the levels in the regions of the country unaffected by nuclear installations are typically higher than the levels in the surrounding of nuclear power plants.

Table C.2.31: Maximum activities of commodities observed in 2008 within territorial monitoring, independent monitoring of NPP Temelín and NPP Dukovany, and monitoring of NPP Temelín performed by the plant operator

Component	Unit	Maximum level			
		Independent monitoring			Temelín plant operator
		Territorial	NPP Temelín	NPP Dukovany	
^{137}Cs					
Aerosols	Bq/m^3	$7.9.10^{-6}$			< $4.4.10^{-6}$
Fallout	Bq/m^2	$2.5.10^{-1}$	< $1.8.10^{-1}$	$1.7.10^{-1}$	< $3.0.10^{-1}$
Surface water	Bq/l	$7.2.10^{-3}$			< $1.5.10^{-2}$
Drinking water	Bq/l	$1.7.10^{-3}$			< $1.5.10^{-2}$
Ground water	Bq/l				< $1.5.10^{-2}$
Milk	Bq/l	$1.8.10^{-1}$	$1.0.10^{-1}$	$3.8.10^{-1}$	< $1.4.10^{-1}$
Cereals	Bq/kg	$1.8.10^{-1}$	< $6.3.10^{-2}$	$9.6.10^{-2}$	< $1.6.10^{-1}$
Fruit	Bq/kg	$2.5.10^{-1}$	< $9.4.10^{-2}$	< $5.3.10^{-2}$	< $3.9.10^{-1}$ [3] [4]
Forest fruits	Bq/kg	$3.8.10^{2}$	5.1	$5.8.10^{-2}$	1.7 [4]
Mushrooms	Bq/kg	$1.2.10^{4}$	$2.6.10^{1}$		
Fish (meat)	Bq/kg	3.2			1.2
Animal feed	Bq/kg		3.1 [5]	$2.4.10^{-1}$	6.0 [4]
^{90}Sr					
Surface water	Bq/l	$1.0.10^{-2}$			< $4.6.10^{-2}$
Milk	Bq/l	$7.0.10^{-2}$			< $1.9.10^{-2}$
^{3}H					
Surface water [1]	Bq/l	9.7	$4.1.10^{2}$	$1.2.10^{3}$	$1.78.10^{2}$
Surface water [2]	Bq/l	1.4	$1.1.10^{1}$	< 1.8	4.9
Drinking water	Bq/l	1.7	< 1.5	< 1.5	< 3.2

Notes:
1) Surface water affected by NPP discharges
2) Surface water not affected by NPP discharges
3) Apples
4) Relative to dry weight
5) Hay
The value following the "<" sign is the MVA except in the Temelín plant operator column, where it is the MDA.

C.2.3.3.2.4. Summary

From the results of radiation monitoring performed by the Radiation Monitoring System and by the independent monitoring project for NPP Temelín and its surroundings it can be concluded that no significant radioactivity leak from the nuclear power plant into the environment occurred during the period of NPP operation, i.e. from 2002 till the present (2008). No level exceeding the specified intervention levels requiring implementation of provisions to protect the population and/or the environment has ever been recorded by any of the measuring sites involved. Variations in the observed dose rate levels are due to natural background fluctuations (seasonal effects, climatic and weather conditions).

Total atmospheric discharges of the individual radionuclides from the Temelín NPP during the given period never exceeded 0.7% of the regulatory annual limit (40 μSv); activities of ^{3}H and the activation, corrosion and fission products discharged from the control reservoirs into watercourses never exceeded 20% of the regulatory annual limit (3 μSv). In normal operating conditions, the highest contributions to the liquid and atmospheric radioactivity releases come from ^{3}H and ^{14}C, respectively.

The data reported by the plant operator are supported by the monitoring projects implemented by independent bodies.

Measurably increased ^{3}H levels are observed in watercourses into which the liquid discharges are drained, the increase, however, is not higher than as observed at other NPPs. The observed maxima are due to time coincidence between the discharging procedure and the sampling procedure.

The observed ^{14}C activities in the biota of the NPP Temelín nearby surroundings do not deviate appreciably from the range of levels for natural fluctuations of this radionuclide in the environment. The ^{14}C activity in the NPP Temelín surroundings is statistically significantly elevated as compared to the reference sites with low or medium local burdens from the firing of fossil fuels. A similar low increase in ^{14}C in the biota of the nearby surroundings, statistically demonstrable on a larger set of data only, is typical of the majority PWR type nuclear power plants.

Apart from the increased ^{3}H in watercourses and ^{14}C in the biota, no significant differences between the NPP Temelín surroundings and the remaining parts of the country were found as regards the radionuclide contents of the various components of the environment or the food chains.

A very low activity of ^{137}Cs from the Chernobyl accident and from nuclear weapon tests is still detectable in the environmental compartments, in food chain components and in humans. Its specific activities are remaining virtually constant now,

C.2.3.4. Non-ionising radiation

The power generation facilities (generators, transformers) are enclosed on the premises of the plant and their electric/magnetic fields do not affect publicly accessible areas. The plant includes power output lines to the Kočín substation (two 400 kV lines) and power supply lines to the plant from the Kočín substation (two 110 kV lines). The lines run through the publicly accessible area between the power plant and the substation; no permanent residential buildings, however, are located there.

Measurement of the electric and magnetic field levels is not included in the project [1]. Standard technical solutions are used; the area is unoccupied; and the power plant is operated based on a valid licence, and thus no conflict with public health limits are expected.

[1] This requirement was not even imposed within the identification procedure.

C.2.4. Surface water and ground water

C.2.4.1. Surface water

C.2.4.1.1.Hydrological categorisation

NPP Temelín is located in the Vltava River basin area in the northern part of the České Budějovice basin. From the hydrological aspect, it is located on the divide of the Vltava and Bílý Brook, the latter being classed as the upper course of the Radomilický Brook to the Blanice basin. The two basins combine in the pond system at Dívčice. The southwestern area used to be drained by the Temelínecký Brook, which had its head area there. After some 5 km the Temelínecký Brook runs into Bílý Brook. The larger northeastern part of the construction site was drained directly into the Vltava through the 6 km long Strouha Brook, emptying into the Vltava River at 214.118 km, through the 5 km long Hradní Strouha and emptying into the Vltava River at 212.669 km, and through the 9 km Palečkův Brook emptying into the Vltava River at 208.151 km. All those brooks had their head areas within the plant site.

In the hydrological classification of the Czech Republic, the NPP Temelín area lies on the divide of the partial catchment areas 1-06-03 (the Vltava from the Malše to the Lužnice) and 1-08-03 (the Blanice and the Otava from the Blanice to the Lomnice), specifically on the divide of the small catchment areas 1-06-03-077 (drained by the Palečkův Brook), 1-06-03-073 (drained by the Strouha), 1-08-03-079/2 (drained by the Temelínecký Brook), and 1-08-03-079/3 (drained by the Malešický Brook).

The area of power output to the Kočín substation lies in catchment area 1-08-03-079/3 and is drained by the Malešický Potok.

Following landscaping and construction of a rainwater sewer system, the majority of the plant area is currently drained via safety basins into a retention reservoir and further on, through the Strouha Brook emptying into the Vltava River at 214.118 km. The area of the construction site facilities to the northeast of the plant area will be drained via a retention reservoir into the Palečkův Brook, running approximately 9 km and emptying into the Vltava (208.151 km). The western periphery of the area is drained by the Temelínecký Brook (northwestern part) and the Malešický Brook (southwestern part), both emptying into the Bílý Brook (Blanice basin), which empties into the Radomilický Brook. The Vltava and Blanice basins combine in the pond system at Dívčice, which means that water from the Radomilický Brook can run into the Vltava River / Blanice River.

A substantial part of hydrology is associated with the Vltava River, from which the plant takes untreated water at Hněvkovice and into which process wastewater is discharged at Kořensko and which absorbs rainwater from the plant area in the reservoir at Hněvkovice. The Vltava River is the backbone of the Bohemian river system, and a series of reservoirs and dams forming the “Vltava cascade” has been built on it, mainly for power generation purposes, although the water management and recreational aspects are important as well. For the needs of NPP Temelín the system has been completed with the Hněvkovice reservoir, from which the plant takes untreated water, and with the underground facility at Kořensko, in which the drained wastewater is mixed with water of the Vltava River.

The Lužnice River also plays a role: this is a tributary of the Vltava at Kořensko increasing the water flow in that area, to which wastewaters from the plant are drained. However, it is not directly involved in water supply to the plant, nor does it affect water flow to the construction site.

From among the more remote watercourses, the following are worth mentioning: the middle and lower courses of the Blanice from the Husinec reservoir into the mouth of the Otava (approximately 60 km), the segment of the Otava from Čejetice into the mouth of the Vltava in the Orlík reservoir (approximately 43 km), and the lower course of the Lužnice from Tábor into the mouth of the Vltava also in the Orlík reservoir on the Vltava (approximately 40 km). The Blanice and Otava rivers have no water-management ties to the Temelín NPP. The Blanice River is of marginal interest, draining the western periphery of the plant area through its tributaries (Temelínecký Potok and Malešický Potok).

C.2.4.1.2.Watercourses, flow rates, yields

The tables of the major hydrological data reproduced below demonstrate that the Vltava possesses rather large water amounts in the plant area and the flow rates fluctuate appreciably, with marked minima. Hydrological data of the Lužnice River are included because this river contributes to the safe flow level at the site where the wastewaters from the plant are emptied into the Vltava at Kořensko (downstream of the Vltava - Lužnice confluence).

Table C.2.32: Hydrological data: basic parameters

River	Site	River basin area [km^2]	Mean annual data				
			Precipitation [mm]	Runoff [mm]	Runoff factor	Specific runoff [l/s.km^2]	Flow rate [m^3/s]
Vltava	Hluboká nad Vltavou	3,450.87	739	276	0.37	8.73	30.1
Lužnice	mouth	4,226.17	667	181	0.27	5.75	24.3
Vltava	downstream of the Lužnice	7,871.26	698	221	0.32	7.01	55.2

The table below gives the M-day waters, indicating the mean number of days in a year during which the flow rates specified are attained/exceeded.

Table C.2.33: Hydrological data: M-day waters [m^3/s]

River	Site	30	90	180	270	330	355	364
Vltava	Hluboká nad Vltavou	66.5	36.3	20.9	13.0	8.56	6.2	4.2
Lužnice	mouth	54.2	29.1	16.5	9.55	5.26	2.95	1.81
Vltava	downstream of the Lužnice	123	66.5	39.1	24.0	14.8	9.42	6.21

The table below gives the N-year waters, indicating the mean number of years during which the flow rates specified are attained/exceeded once.

Table C.2.34: Hydrological data: N-year waters [m^3/s]

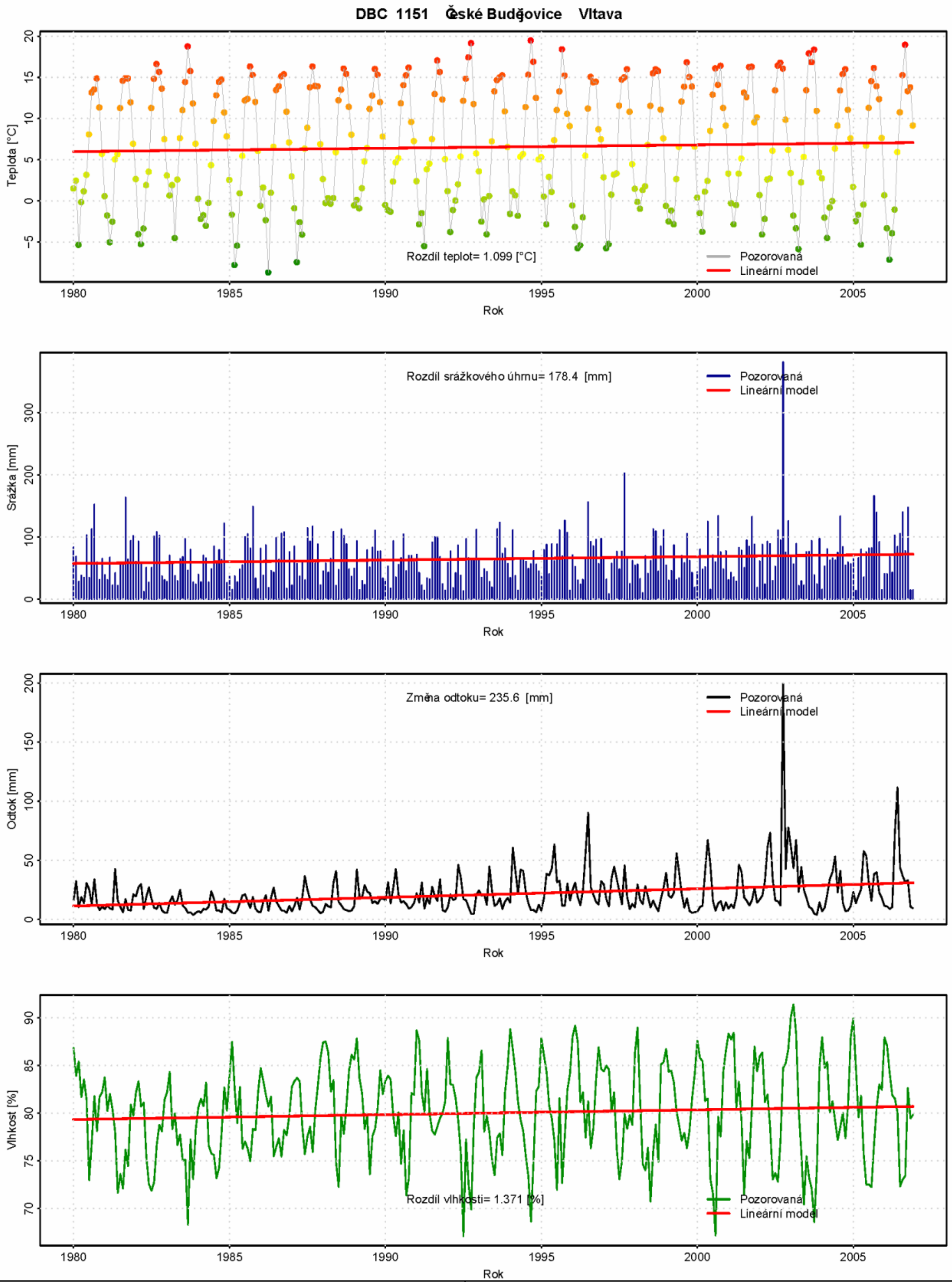
River	Site	1	2	5	10	20	50	100
Vltava	Hluboká nad Vltavou	184	291	437	553	679	844	970
Lužnice	mouth	107	158	249	316	390	480	565
Vltava	downstream of the Lužnice	300	440	660	825	1,020	1,300	1,460

Operation of the plant will have quantitative impacts especially on the Vltava segment between the Hněvkovice reservoir (water withdrawal) and the Kořensko reservoir (wastewater discharge). Those sites are affected by water management at the upstream-lying Lipno and Římov reservoirs. The up to 100% increase in the low flow rates is substantial, whereby the impact of the plant operation is eliminated in comparison with the unaffected situation.

In view of the expected long-term operation of the new nuclear installation, the feasibility of water withdrawal from the Hněvkovice reservoir for the future extension of NNP Temelín was analysed within a study (L. Kašpárek, 2009), and the impacts on the Vltava River as far as its mouth were analysed. The study also includes results of analysis of the time trends of various climatic parameters and a description of hydrological balance modelling and setting-up time series affected by climatic change for the Vltava River.

The graphs below show the development of climatological parameters having adverse impacts on the hydrology in the area during the 1980-2007 period for the Vltava River segment from České Budějovice (upstream of NPP Temelín) to Orlík (downstream of the NPP).

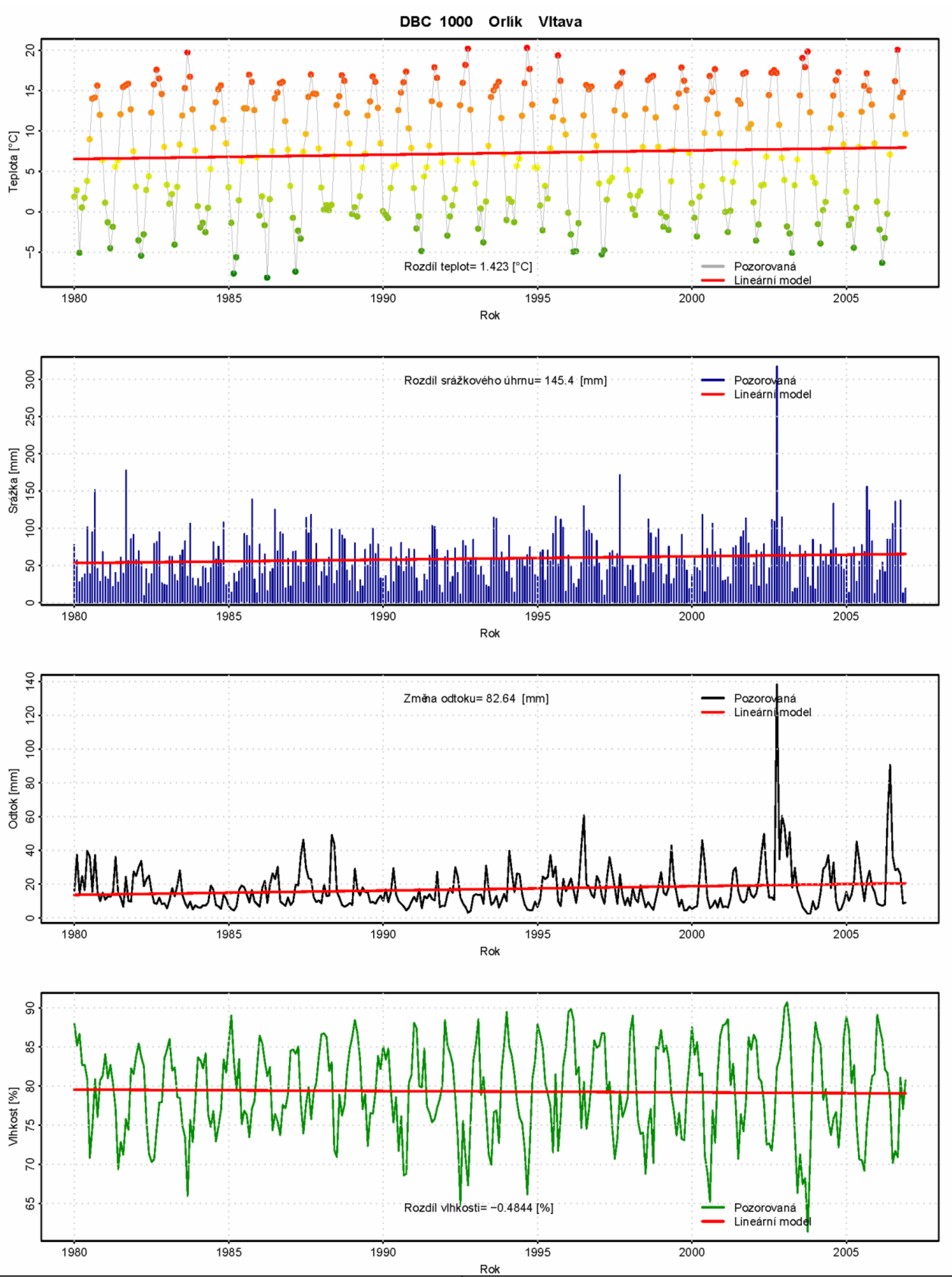
Figure C.2.62: Climatological parameters of the Vltava basin at České Budějovice



Teplota	Temperature
Rok	Year
Rozdíl teplot	Temperature difference
Pozorovaná	Observed

Lineární model	Linear model
Srážka	Precipitation
Rok	Year
Rozdíl srážkového úhrnu	Difference in total precipitation
Pozorovaná	Observed
Lineární model	Linear model
Odtok	Runoff
Rok	Year
Změna odtoku	Runoff change
Pozorovaná	Observed
Lineární model	Linear model
Vlhkost	Humidity
Rok	Year
Rozdíl vlhkosti	Difference in humidity
Pozorovaná	Observed
Lineární model	Linear model

Figure C.2.63: Climatological parameters of the Vltava basin at Orlík



DBC 1000	DBC 1000
Teplota	Temperature
Rok	Year
Rozdíl teplot	Temperature difference

Pozorovaná	Observed
Lineární model	Linear model
Srážka	Precipitation
Rok	Year
Rozdíl srážkového úhrnu	Difference in total precipitation
Pozorovaná	Observed
Lineární model	Linear model
Odtok	Runoff
Rok	Year
Změna odtoku	Runoff change
Pozorovaná	Observed
Lineární model	Linear model
Vlhkost	Humidity
Rok	Year
Rozdíl vlhkosti	Difference in humidity
Pozorovaná	Observed
Lineární model	Linear model

The above graphs demonstrate that temperature increased roughly by 1°C to 1.5°C during the analysed period. This increase has an adverse impact on the hydrological balance (potential increase of evapotranspiration and water evaporation from the ground), which, however, is compensated by an increase in total precipitation at the majority of sites. Reduced relative humidity is also among adverse impacts, which was at the level of unit percentage during the analysed period.

The tables below include hydrological data of the Strouha and Palečkův brooks, which drain the northeastern and eastern parts of the plant area surroundings and have their head sites there. They are left tributaries of the Vltava at the Hněvkovice reservoir (Strouha Brook) and the Kořensko reservoir (Palečkův Brook). The brooks are short and have a large slope. Their catchments are non-settled, 50% afforested areas. They are mountain streams of local importance. The hydrological data at the sites where they empty into the Vltava are as follows.

Table C.2.35: Hydrological data of the Strouha and Palečkův brooks

Brook	Vltava River km	Course length [km]	Basin area [km^2]	Mean runoff [l/s]
Strouha	214.118	8	13.173	43
Palečkův Brook	208.151	9	12.14	40

	Flow rates [l/s] exceeded during N days in a year in the average						
Brook	90	120	180	210	270	355	364
Strouha	52	45	40	38	30	18	12
Palečkův Brook	48	42	37	36	28	17	11
	Flow rate [m^3/s] attained once in N years in the average						
Brook	1	2	5	10	20	50	100
Strouha	2.2	3.4	5.8	8.0	11.0	13.0	16.0
Palečkův Brook	2.0	2.9	5.0	7.0	9.5	11.0	14.0

A small western part of the area (Temelínec dumping area) is drained by the Temelínecký Brook, running approximately 5 km to empty into the Bílý Brook, or in view of the combination of the river catchment areas in the pond system at Dívčice, it can empty into the Radomilský Brook. This modification was accomplished within amelioration work in the late 1960s and early 1970s. The initial Bílý Brook bed can be used to alleviate high flow during floods. The Malešický Brook drains water from the southern part of the plant area. Hydrological data of the brooks are presented in the tables below:

Table C.2.36: Hydrological data of additional local watercourses

Brook	Precipitation [mm]		Basin area [km^2]		Mean runoff [l/s]	
Malešický Brook	596		8.35		27	
Temelínecký Brook (dam in the village)	596		0.86		3	
Temelínecký Brook (mouth into the Bílý Brook)	599		14.16		48	
Bílý Brook (downstream of the Temelínecký Brook mouth)	601		25.37		86	
Radomilický Brook (mouth)	600		89.11		303	
	Flow rates [l/s] exceeded during N days in a year in the average					
Brook	90	120	180	210	270	355	364
Malešický Brook	33	29	25	24	19	12	8
Temelínecký Brook (dam in the village)	4	3	3	2	-	-	-
Temelínecký Brook (mouth into the Bílý Brook)	58	50	45	43	33	21	13
Bílý Brook (downstream of the Temelínecký Brook mouth)	104	90	80	76	59	37	24
Radomilický Brook (mouth)	339	267	212	188	158	64	45
	Flow rate [m^3/s] attained once in N years in the average						
Brook	1	2	5	10	20	50	100
Malešický Brook	1.4	2.1	3.6	4.9	6.8	7.9	9.9
Temelínecký Brook (dam in the village)	0.7	1.0	1.2	2.6	3.4	4.3	5.2
Temelínecký Brook (mouth into the Bílý Brook)	2.8	3.5	4.6	5.6	6.7	9.5	13.4
Bílý Brook (downstream of the Temelínecký Brook mouth)	4.2	5.1	6.7	8.5	10.0	14.0	20.0
Radomilický Brook (mouth)	8.6	12.0	16.0	18.0	23.0	31.0	41.0

Landscaping following the start of the NPP construction brought about some changes in the area's hydrological parameters. A fraction of the rainwater is drained from the plant area to the Strouha basin.

C.2.4.1.3.Water reservoirs

Retention reservoirs

Three new retention reservoirs have been built in the vicinity to serve the construction and operation of the new nuclear installation. A retention reservoir with overflow into the Palečkův Brook was built north of the plant area to retain and accumulate increased runoff from the northern part of the construction site facilities. A small retention reservoir to retain water from the eastern part of the construction site and from nearby roads has been built east of the area, on a nameless tributary. The most important of the retention reservoirs is Býšov, located southeast of the plant area, on the Strouha Brook downstream of the safety reservoirs. This retention reservoir serves to retain any increased amounts of rainwater, which is drained from the plant area through the rainwater sewer system.

Ponds

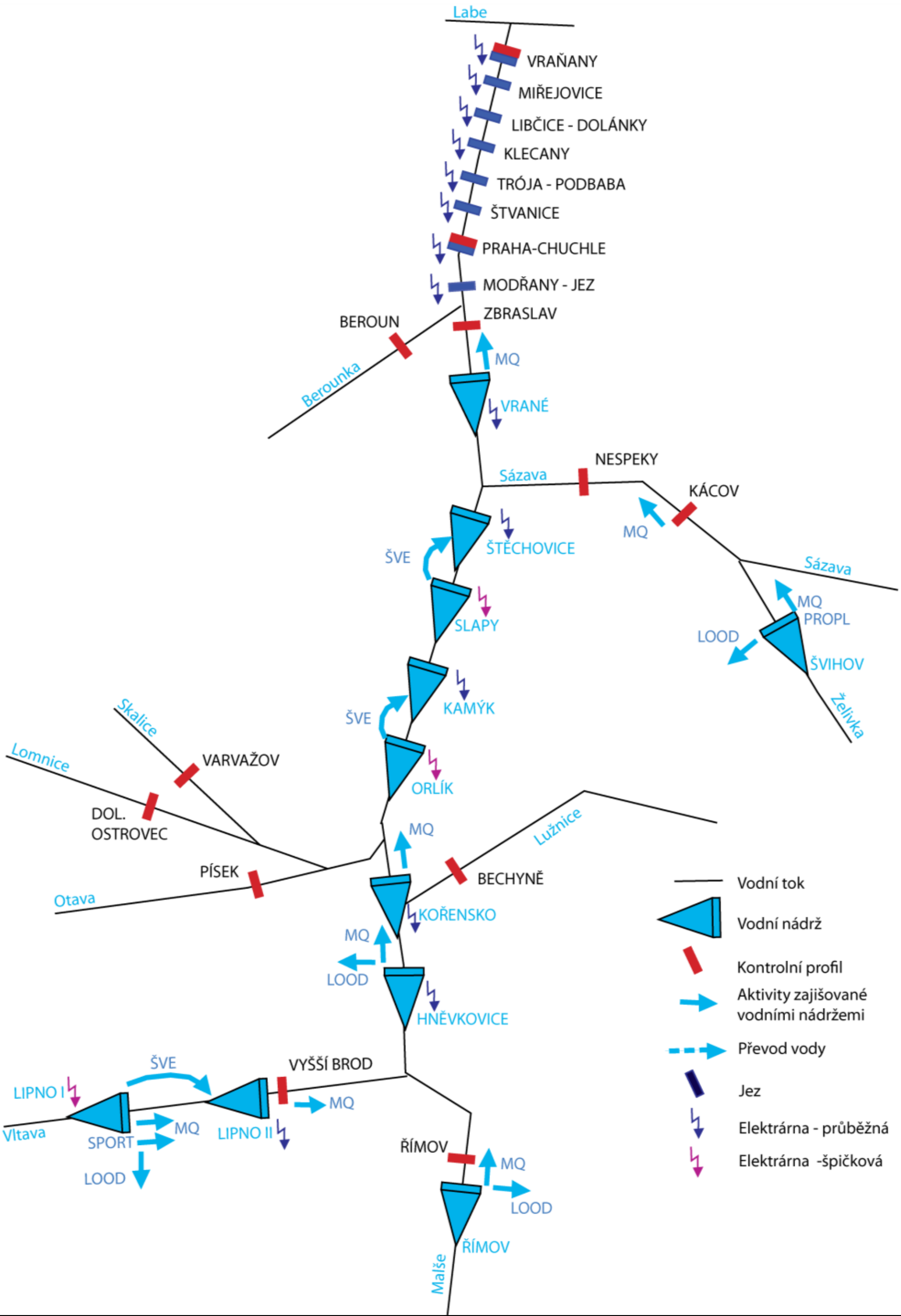
Dozens of small ponds are scattered around the NPP Temelín site. Ponds of some importance lie on the Radomilický (Bílý) Brook. The ponds are used for extensive fish farming. Blatec (96.8 ha, 416 thousand m^3), Bělehůrecký Rybník (53.6 ha, 983 thousand m^3) and Strpský Rybník (40 ha, 480 thousand m^3) are the largest ponds within the 13 km zone around the plant.

Water reservoirs

In view of the fact that the operation of the current NPP Temelín plus the new nuclear reactors may put additional requirements on the availability of water, i.e. particularly on the minimum flow rates, water levels in the reservoirs, and other water withdrawal factors in the basin, both for the current hydrological situation and the situation affected by climate change, as analysed in detail within a study (Kašpárek et al., September 2009). The water management solution was developed both for the existing hydrological situation and for the hydrological situation affected by climate change to the horizon of 2025.

Profiles of water reservoirs fulfilling the storage, balance function, profiles with defined requirements for a minimum flow rate, profiles of selected water measuring stations and profiles where the impact on electricity generation by hydroelectric power plants is being assessed were selected as the water management system profiles (see the layout below).

Figure C.2.64: Layout of the water management system



Vodní tok	River
Vodní nádrž	Water reservoir
Kontrolní profil	Control profile
Aktivity zajišťované vodními nádržemi	Activities secured by water reservoirs
Převod vody	Water transfer

Jez	Weir
Elektrárna – průběžná	Power plant - normal
Elektrárna – špičková	Power plant - peak

The Lipno, Hněvkovice, Kořensko and Orlík reservoirs are important with respect to the withdrawal of water and homogenisation of the discharged waters.

The purpose of the Lipno reservoir is to ensure:

- At the Lipno I dam profile:
  - A minimum outflow from the reservoir (in the old bed of the Vltava River)
  - Water withdrawal for Loučovice
  - Use of hydropower,
  - Discharge of 1.7 mil. m^3 of water (August) for canoe racing events
- In the Lipno II dam - Kořensko segment:
  - A minimum flow rate downstream of the Lipno II reservoir
  - Water withdrawal for the Temelín NPP (in cooperation with the Hněvkovice reservoir)
  - A minimum flow rate downstream of the Hněvkovice reservoir (in cooperation with the Hněvkovice reservoir)
  - A minimum flow rate downstream of the Kořensko reservoir (in cooperation with the Hněvkovice reservoir)

The purpose of the Hněvkovice reservoir is to ensure:

- At the dam profile:
  - A minimum outflow from the reservoir (in cooperation the Lipno I reservoir)
  - Direct water withdrawal for NPP Temelín (in cooperation with the Lipno I reservoir)
  - Electricity generation by the semi-peak hydroelectric power plant
- In the dam - Kořensko segment
  - Surface water withdrawal
  - A minimum flow rate downstream of the Kořensko reservoir (in cooperation with the Lipno I reservoir)

The purpose of the Kořensko reservoir is to maintain a constant water level, thereby enabling wastewater from NPP Temelín to be safely discharged, and to generate power in the continuous hydroelectric power plant. The weir basin has no storage volume.

The purpose of the Orlík reservoir is to ensure:

- At the dam profile:
  - Use of hydropower by the peak hydroelectric power plant
- In the Kořensko - Vrané segment:
  - Water use demands (in cooperation with the Slapy reservoir for the Slapy - Vrané segment)
  - A minimum flow rate downstream of the Vrané reservoir (in cooperation with the Slapy reservoir)

C.2.4.1.4.Hydrological situation affected by climate change

A study of the feasibility of water withdrawal from the Hněvkovice reservoir for the future extension of NPP Temelín has been prepared for the assessment of current and future demands and supply of water for the plant in relation to additional requirements for water use, i.e. particularly requirements for minimum flow rates, water level in the reservoirs and other water withdrawals from the river basin, both for the current hydrological situation and for the hydrological situation affected by climate change (see Annexes hereto).

Solutions have been developed for the following scenarios (hydrological background representing the time levels with respect to the reference year):

2009:

- P: observed flow rate series
- M: modelled flow rate series

2020:

- A: Extrapolation of the current status taking into account climate models 2085 for a +1.1°C temperature change and -4% total precipitation change
- 0: Extrapolation of the current status taking into account climate models 2085 for a +0.9°C temperature change and -2% total precipitation change
- B: Extrapolation of the current status taking into account climate models 2085 for a +0.7°C temperature change
- C: Interpolation of the 1980-2006 trend for a +1.1°C temperature change, +4% total precipitation change and +2% humidity change

2025:

- ALADIN regional climate model for emission scenario A1B

2050:

- HadCM2 global climate model for emission scenario B1

2085:

- B: RCAO-B2 climate change scenario
- 0: RCAO-B2 climate change scenario
- C: HIRHAM-A2 climate change scenario
- C: Scenario for 2050 extrapolated to 2085
- D: Scenario for 2050 extrapolated to 2085, improvement of the dry year 1943

The following information follows from the study:

Scenarios with 2020 as the reference year

Air temperature change will be constant in the various scenarios and will lie within the range from +0.7°C to +1.1°C. This also applies to the mean total precipitation change, which lies within the range from -4% to +4%. Humidity is assumed to be at the current level, except for scenario 2020_C where a 2% increase is modelled.

Scenarios with 2025 as the reference year

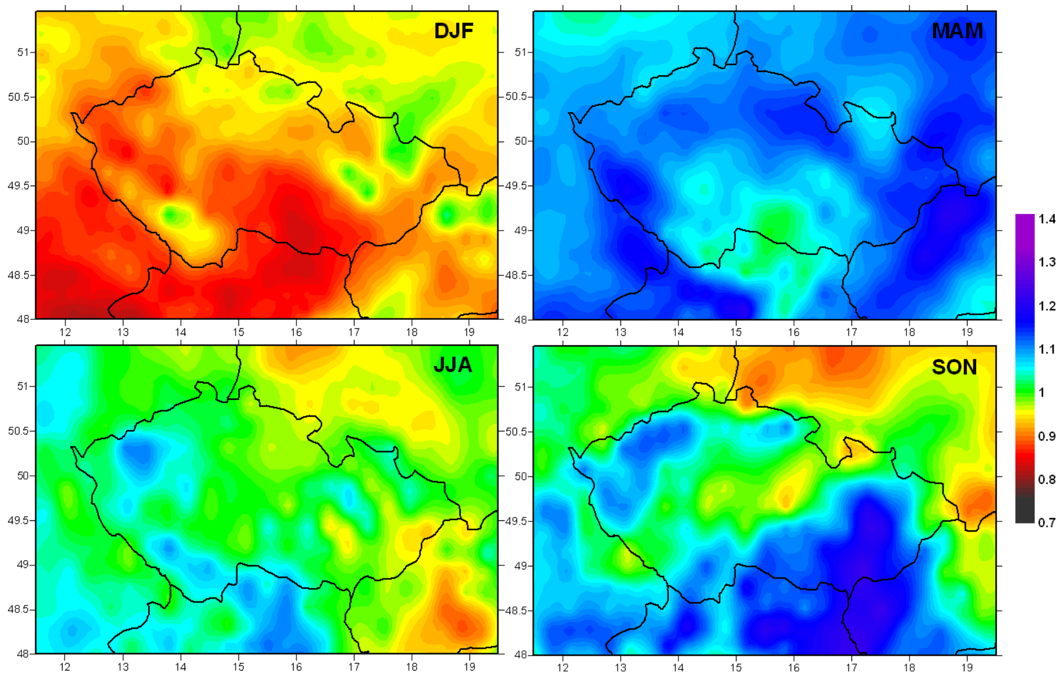
Integration of the ALADIN - CLIMATE/CZ regional climate model and the A1B emission scenario (for 1961-2050) was completed by scientists of the Faculty of Mathematics and Physics, Charles University, in 2008. This scenario expects a rapid growth of global economy, development of new technologies, the country will have reached the maximum number of population by the mid-2000s, and an equilibrium is expected to have established in the use of all the various types of energy. The model's horizontal resolution is 25 km. The outputs of the ALADIN model in the form of a time series for the 1961-1990 period in a 6-hour time resolution were converted to daily data. The calculation results include daily mean, maximum and minimum air temperatures and total daily precipitation. Subsequently, the calculated values were validated by comparison with a set of measured data obtained by uploading available data from stations into the ALADIN model network.

The model demonstrates that air temperature will increase in the 2010-2039 reference period as compared to the 1961-1990 period roughly by 1°C in the average, the increase being largest during autumn, up to 1.5°C.

The situation is more complex for the seasonal precipitation change. A decrease (0 to 15%) in precipitation will be experienced in winter, whereas the spring season will see an increase (0-10%), and the situation will be different in the different regions of the Czech Republic during the summer and autumn seasons. A rather marked spatial variability of the changes is apparent.

The expected annual trend of total precipitation in 2010-2039 is shown in the maps below (processed following Pretel et al., 2008).

Figure C.2.65: Proportions [%] of seasonal precipitation simulated by the ALADIN model for the periods of 2010-2039 and 1961-1990 during the winter (DJF), spring (MAM), summer (JJA) and autumn (SON) seasons



Hydrological balance prediction by using the ALADIN 2025 scenario for the A1B emission scenario includes an adverse impact on the outflow levels at each basin during each month. The summer months (August, September, October), during which the flow rates will naturally attain low levels, are least favourable. The decrease in the mean annual flow rate is approximately 10 to 20% in this scenario.

Scenario with 2050 as the reference year

The HadCM2 global climate model for the SRES B1 emission scenario possesses a low temperature sensitivity, the mean monthly air temperature will increase by 0.5°C to 1.3°C for this reference period. The mean monthly total precipitation will increase up to 8% in the winter season, whereas a decrease is simulated in summer, up to 7% in August and September.

Scenarios with 2085 as the reference year

Temperature changes during the year will be highly variable for the 2085 horizon. Nevertheless, all scenarios predict the highest warming in August, by 5°C to 7°C, and the lowest warming in January to March (1°C to 4°C).

No substantial change in total annual precipitation is predicted by any of the climate models. Nevertheless, the predicted change in the yearly precipitation patterns is highly relevant with respect to the outflow. The typical patterns include a marked increase in total precipitation during the winter months (December - March) by approximately +20% to +50% in the territory modelled, and a marked decrease in the summer months (June - September) by approximately -20% to -50% in the territory modelled.

Conclusion

The following conclusions can be drawn from the results of the water-management solution affected by climate change:

In the medium-term perspective (reference years 2020 and 2025), water withdrawal for Temelín can be ensured safely, i.e. as recommended by ČSN 75 2405 and without failures of supply, for any of the new nuclear installation power output alternatives and assuming any of the climate change scenarios applied. The requirements for the minimum flow rates downstream of the Lipno I, Lipno II, Hněvkovice and Kořensko dams and for attaining a navigable depth at the Hněvkovice reservoir will also be satisfied. If the entire water storage volume of the Lipno I reservoir is also used for water accumulation, water withdrawal for NPP Temelín can safely be sufficiently ensured, even if the storage volume of the Hněvkovice reservoir is limited by the need to ensure a required water level for recreational cruises.

In the long-term perspective (reference year 2085), water withdrawal assuming the 2x1200 MW_e power alternative is ensured in all the climate change scenarios provided that the entire existing volume of Lipno I is used for accumulation (at a rather highly ensured [p_t = 94.06%] navigable depth in the Hněvkovice reservoir). As of the reference year 2085, water withdrawal is also ensured reasonably safely for the 2x1700 MW_e power alternative in nearly all the climate change scenarios (if the whole storage volume of Lipno I is also used for accumulation). The critical, pessimistic 2085_A (HIRHAM-A2) climate change scenario, assuming an unfavourable development of greenhouse gas emissions, is an exception. However, if the entire storage volume of the Lipno I reservoir is used, withdrawal for the 2x1700 MW_e power alternative is secured at a p_t = 99.01% probability level.

No significant adverse impacts of water withdrawal for the Temelín NPP on the other water use requirements (including electricity generation) on the Vltava River were revealed by the study. Any potential problems with minimum flow rates and with a reduced potential for power generation on the Vltava cascade indicated by the scenarios for the 2025 perspective would be primarily, and to the decisive extent, due to climate change, the plant's water demands playing a minor role in this.

C.2.4.1.5. Water withdrawal

There are no waterworks reservoirs on the Vltava itself. Important water supply reservoirs have recently been built on the Vltava's tributaries, specifically the Švihov reservoir on the Želivka and the Římov reservoir on the Malše. Direct withdrawal from the river is limited by the variable water quality and high variability of the flow rates. Only two sites on the Vltava River are used for drinking water supply; at Solenice (144 km) for the Příbram area and at Prague - Podolí (56.2 km), with a capacity as high as 2,600 l/sec, for Prague. Because of an unsuitable water quality, the two sources are categorised as sources for temporary use only.

There have been dozens of water withdrawals from the Vltava, and only the permitted withdrawal for the NPP based on the valid untreated water withdrawal licence issued by the Týn nad Vltavou Municipality, Environment Department (file OŽP/7497/2009/Si dated 27 February 2007), is reported here.

The following limits have been set by the licence:

Q_{mean} 1,800 l/sec
Q_{max} 3,000 l/sec
Q_{month} 6,000,000 m^3/month
Q_{year} 42,000,000 m^3/year (in this, 456,400 m^3/year earmarked for Býšov).

It is the administrator's responsibility, during the withdrawals, to secure a minimum flow rate of 6.5 m^3/sec downstream of the Hněvkovice reservoir.

C.2.4.1.6. Floods

The plant is sited on the divide of local watercourses as well as of watercourses of importance from the water management aspect. The plant area itself lies higher than the surrounding ground, with a roof-shaped slope to all directions. It lies approximately 135 m above the maximum levels in the major watercourses, even if historical extreme flow rates are included. Thus the plant cannot be endangered by high flow rates in any of the rivers. It cannot be flooded even if the watercourses are blocked by ice.

C.2.4.1.7. Surface water quality

The major fraction of non-radioactive substances drained in the wastewaters from NPP Temelín is pumped with the service water. The quality indicator trends are shown in the table below.

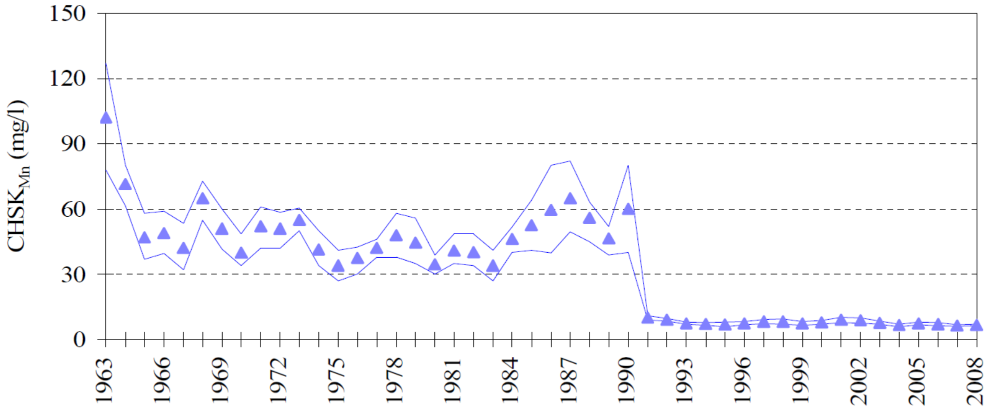
Table C.2.37: Withdrawn untreated water quality trends, 2002-2008

Indicator	2002*	2003	2004	2005	2006	2007	2008
BOD_5 [mg/l]	3.09	3.00	2.22	1.81	2.19	1.96	2.98
COD_{Mn} [mg/l]	8.77	7.74	6.63	7.43	7.08	6.46	6.68
COD_{Cr} [mg/l]	27.96	21.93	14.83	24.25	18.58	17.58	16.67
SO_4 [mg/l]	30.78	28.27	26.98	20.57	20.5	19.32	19.90

$N_{inorg.}$ [mg/l]	2.5	1.633	1.627	1.41	2.27	1.24	1.50
P-PO_4 [mg/l]	0.07	0.05	0.021	0.03	0.029	0.018	0.026
P_{total} [mg/l]	0.11	0.12	0.07	0.1	0.09	0.07	0.07
SS [mg/l]	< 18.17*	< 12.25	< 8.00	< 9.33	< 9.08	< 8.83	< 7.58
NES [mg/l]	< 0.06	< 0.05	< 0.05	< 0.06	< 0.05	< 0.06	< 0.05
Tens. in. [mg/l]	< 0.15	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
DIS	88.25	86.33	68.67	64.5	69.45	63.33	63.00
pH [-]	7.56	7.51	7.46	7.43	7.31	7.35	7.40
Coductivity [µS/cm]	192	192	178	157	163	144	156
* August 2002 floods							

In view of the fact that the quality of water taken for the plant from the Vltava at Hněvkovice substantially affects the quality of the discharged wastewaters, where cooling water concentrated by evaporation represents the major fraction, the long-term trends of the important indices - COD_{Mn}, NO_3^-, NH_4^+ and PO_4^{3-} - were analysed. The trend of the mean annual levels of the above indices along with the confidence intervals is shown in the graph below.

Figure C.2.66: Development of the mean annual COD_{Mn} levels and the confidence interval for the Vltava River at Hněvkovice, 1963-2008

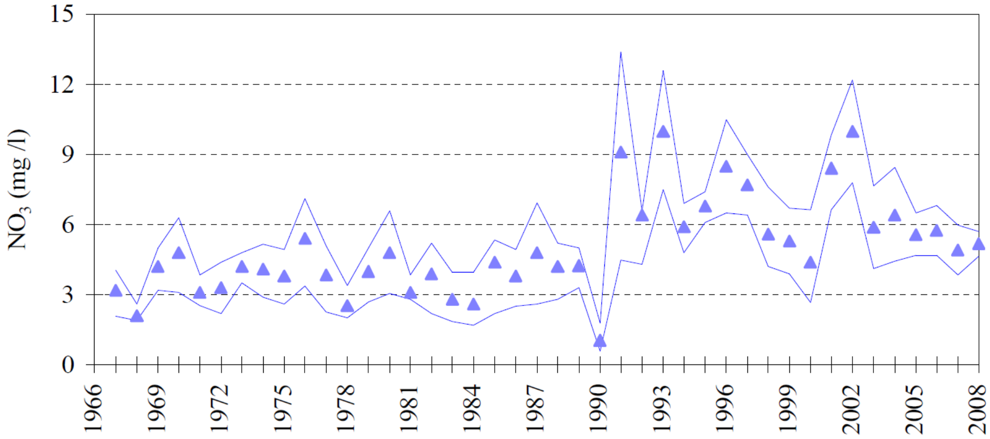


$CHSK_{Mn}$	COD_{Mn}

It is clear that during the period between 1963 and 1990 the Vltava River was markedly polluted by wastewaters, mainly from the "JiP Větřní" paper mill, with a mean concentration within the range of 30 to 60 mg.l^{-1}. The situation improved appreciably after 1991, when the evaporator at JiP Větřní was made operable, the wastewater treatment plant in Český Krumlov was launched, and the performance of the wastewater treatment plant in České Budějovice was improved. Between 1993 and 1995, the concentrations decreased from the initial 7.5 mg.l^{-1} to 7.1 mg.l^{-1} and 7.0 mg.l^{-1}, and starting in 1996 a slight concentration increase was observed within a certain range of the mean annual COD_{Mn} levels (COD_{Cr} and BOD_5 are related to that indicator). The trend shows that water quality as expressed through the COD_{Mn} parameter has been basically steady from the long-term retrospective, with a slight quality decrease from 1993-2002 (7.1-9.0 mg.l^{-1}) and improvement in 2003-2008 (6.5-7.7 mg.l^{-1}).

The graph below shows the development of mean annual nitrate concentrations, the next index deserving attention with respect to the regulatory limits imposed on the wastewaters discharged.

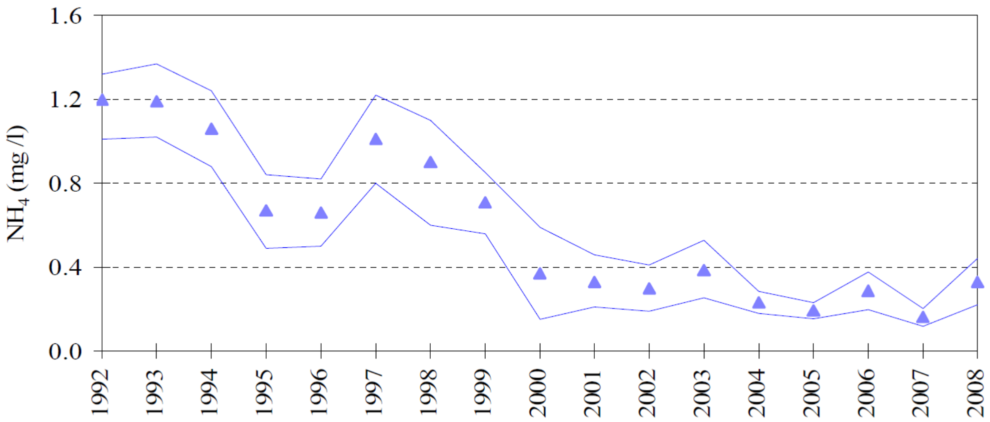
Figure C.2.67: Development of the mean annual NO_3^- concentrations and the confidence interval for the Vltava River at Hněvkovice, 1967-2008



The graph shows that the period starting from 1991 saw a deterioration of the situation. Paradoxically, this was apparently due to more efficient purification of wastewaters from the main pollution sources upstream of the sampling site (JiP Větřní, Český Krumlov and České Budějovice wastewater treatment plants) and to the conversion of N-NH_4^+ to N-NO_3^-. The next period, 1992-1997, saw elevated nitrates within a rather wide range of mean annual concentrations. While the mean annual nitrate levels had been decreasing since 1997, 2001 saw a marked worsening as compared to 2000. During the extremely watery year 2002 the mean NO_3^- concentration was 10.5 mg.l^{-1} (N-NO_3^- 2.4 mg.l^{-1}), hence, even higher than in 2001. This indicator improved appreciably during the extremely dry year 2003, to a mean NO_3^- concentration of 5.9 mg.l^{-1} (N-NO_3^- 1.3 mg.l^{-1}). The mean annual concentration was also low in 2004, NO_3^-: 6.4 mg.l^{-1} (N-NO_3^- 1.4 mg.l^{-1}). The mean annual NO_3^- concentrations in 2005, 2006, 2007 and 2008 were 5.6, 5.8, 4.9 and 5.2 mg.l^{-1}, respectively (N-NO_3^- 1.3, 1.3, 1.1 and 1.2 mg.l^{-1}, respectively); the NO_3^- concentrations were derived from the results of determination of N-NO_3^- before rounding to 1 decimal place. Similar changes, however, had been observed before, during the 1991-2005 period. Whether this is a permanent condition can only be said after a longer monitoring of the trend. It can be concluded in summary that the mean levels do not exceed the pollution standard c_{90}, or the corresponding annual average of 4.5 mg.l^{-1} for N-NO_3^- as stipulated by Government Decree no. 61/2003 (as amended).

The graph below shows the development of ammonium ion concentrations, monitored since 1992 only.

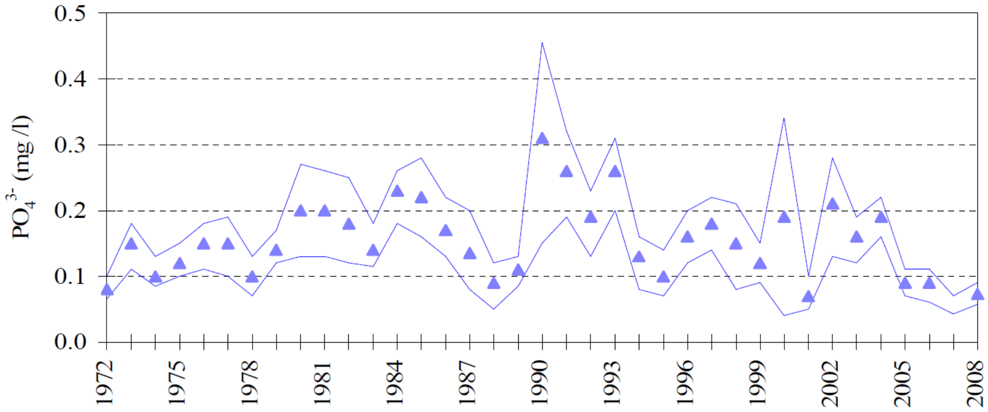
Figure C.2.68: Development of mean annual concentrations of NH_4^+ along with the confidence intervals in the Vltava River at Hněvkovice, 1992-2008



A decreasing trend is apparent. This trend does not correlate with that of nitrate as shown in the preceding graph. During the 1997-2002 period, NH_4^+ exhibited a decreasing trend. The 2002 level was 0.28 mg.l^{-1} (N-NH_4^+ 0.22 mg.l^{-1}), the 2003 level was slightly higher, 0.39 mg.l^{-1} (N-NH_4^+ 0.30 mg.l^{-1}). The 2004-2005 period saw an additional decrease in NH_4^+, to 0.23 mg.l^{-1} (N-NH_4^+ 0.18 mg.l^{-1}), in 2004 and to 0.19 mg.l^{-1} (N-NH_4^+ 0.15 mg.l^{-1}) in 2005. The figures in 2006, 2007 and 2008 were 0.28 mg.l^{-1} (N-NH_4^+ 0,22 mg.l^{-1}), 0.17 mg.l^{-1} (N-NH_4^+ 0,13 mg.l^{-1}) and 0.32 mg.l^{-1} (N-NH_4^+ 0,25 mg.l^{-1}), respectively. The NH_4^+ concentrations were derived from the analytical data for N-NH4$^+$. Since 2000, the N-NH_4^+ concentrations have been relatively steady within the range of 0.17 to 0.39 $mg.l^{-1}$. Since the nitrogen species $N\text{-}NH_4^+$ and $N\text{-}NO_3^-$ (or $N\text{-}NO_2^-$) are genetically interrelated, the future development must be monitored for NH_4^+ as well. The mean annual levels approach the limit for the annual average concentration of 0.23 $mg.l^{-1}$ laid down by Government Decree no. 61/2003 (as amended).

The graph below shows the development of phosphate concentrations. Phosphate started to be monitored in 1972.

Figure C.2.69: Development of the mean annual PO_4^{3-} concentrations and the confidence intervals for the Vltava River at Hněvkovice, 1972-2008



Unlike the concentrations evaluated above, the mean annual phosphate concentrations do not exhibit any significant trend. Instead, the levels occupy a rather wide range. A slight increase occurred till 1985, the next period till 1998 saw a decrease, and starting in 1990, the patterns can be described as an insignificant decrease in the concentrations of PO_4^{3-}. The year-on-year changes in the mean concentrations are appreciable. This can be documented on the mean PO_4^{3-} concentrations in 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007 and 2008, which were 0.19, about 0.07, 0.20, 0.16, 0.19, 0.09, 0.09, 0.06 and 0.07 $mg.l^{-1}$, respectively.

The development of the concentrations of the various quality indicators of the untreated water withdrawn has a marked impact on their levels in the discharged wastewaters, especially in the blowdown from the coolant circuit, where the pollutants are concentrated by evaporation in the cooling towers. For this reason the quality of water in the Vltava River at Hněvkovice from 2004-2008 was subjected to statistical analysis. Evaluated were the mean annual levels and their average as well as the c_{90} values in the various years and over the entire 2004-2008 period. The results are given in the table below.

The following parameters were evaluated: dissolved solids (DS) and suspended solids (SS) dried at 105°C, conductivity, pH, SO_4^{2-}, Cl^-, O_2, non-polar extractable substances (NES), anionic surfactants, temperature, $N\text{-}NH_4^+$, $N\text{-}NO_3^-$, COD_{Mn}, COD_{Cr}, BOD_5, K^+, Na^+, PO_4^{3-}, dissolved inorganic salts (DIS), Ca^{2+}, Mg^{2+} a P_{tot}. As to the indicators monitored, the appropriate pollution (immission) limits laid down by Government Decree no. 61/2003 (as amended) are not reported for conductivity, NES, COD_{Mn}, K^+, Na^+ and PO_4^{3-}. None of the pollution (immission) limits for the indicators evaluated except for the mean O_2 level was exceeded at Hněvkovice.

For the Kořensko site, pollutant concentrations in the Vltava are given separately for the left bank (LB) and right bank (RB) and for the averages. The statistical data are also given in the tabular form below. Although basically similar at the left and right river banks at Kořensko, the concentrations of the indicators at the right bank are slightly poorer, mirroring the poorer water quality in the Lužnice River, emptying into the Vltava just upstream of the sampling site. Comparison with the appropriate pollution standards shows that the pollution standards are exceeded slightly for COD_{Cr} in the c_{90} values at both sites and in the $c_{mean.}$ parameter at the left bank of the Vltava at Kořensko, presumably mirroring the discharge of wastewaters from the wastewater treatment plant at Týn nad Vltavou; nevertheless, the differences in water quality characterised by the COD_{Mn}, COD_{Cr} a BOD_5 indicators between the left and right banks of the Vltava River at Kořensko lie within the range of uncertainty of determination. In the remaining indicators the $c_{mean.}$ and c_{90} values are below the applicable immission limits.

The mean water quality at that site serves as the reference level for assessment of the contributions of the existing NPP Temelín, the new nuclear installation, and their parallel operation. No water quality trends are expected at that site if the pollution sources in the river basin are steady or else improvement is expected if pollution control measures are implemented at the Vltava and Lužnice rivers upstream of the site.

Table C.2.41: Average concentrations c_{mean} and c_{90} concentrations of selected quality indicators in the Vltava River at Hněvkovice downstream of the dam, at Kořensko (left and right banks and average data), 2004-2008, and the c_{mean} and c_{90} pollution limits laid down by Government Decree no. 61/2003 (as amended) (part 1)

Indicator	DS [mg.l^{-1}]	SS [mg.l^{-1}]	Conductivity [mS.m^{-1}]	pH [-]	SO_4^{2-} [mg.l^{-1}]	Cl^- [mg.l^{-1}]	O_2 [mg.l^{-1}]	NES [mg.l^{-1}]	MBAS [mg.l^{-1}]	Temperature [°C]
Hněvkovice downstream of the dam										
c_{mean}	110	8.7	16.0	7.4	21.4	9.5	9.4	0.06	0.06	11.4
c_{90}	148	13.0	19.8	7.6	29.3	12.0	5.1	0.07	0.05	21.0
Kořensko LB										
c_{mean}	137	13.5	20.1	7.6	25.1	14.1	-	0.05	0.05	11.3
c_{90}	166	25	24.3	9.0	29.5	19.4	-	0.06	0.05	21.7
Kořensko RB										
c_{mean}	136	13.2	20.0	7.6	25.1	14.1	-	0.05	0.05	-
c_{90}	162	23	24.2	9.1	30.6	19.1	-	0.07	0.05	-
Kořensko average										
c_{mean}	136	13.3	20.0	7.6	25.1	14.1	-	0.05	0.05	-
c_{90}	164	24	24.3	9.0	30.1	19.3	-	0.07	0.05	-
Government Decree no. 61/2003 (as amended)										
c_{mean}	750	20.0	-	6-8	200	150	< 9	-	0.3	14
c_{90}	1,000	30.0	-	6-8	300	250	> 6	-	0.6	25

Table C.2.41: Mean c_{mean} and c_{90} concentrations of selected quality indicators in the Vltava River at Hněvkovice downstream of the dam, at Kořensko (left and right banks and average data), 2004-2008, and the c_{mean} and c_{90} pollution limits pursuant to Government Decree no. 61/2003 (as amended) (part 2)

Indicator	$N\text{-}NH_4^+$ [mg.l^{-1}]	$N\text{-}NO_3^-$ [mg.l^{-1}]	COD_{Mn} [mg.l^{-1}]	COD_{Cr} [mg/l]	BOD_5 [mg/l]	K^+ [mg.l^{-1}]	Na^+ [mg.l^{-1}]	PO_4 [mg.l^{-1}]	DIS [mg.l^{-1}]	Ca [mg.l^{-1}]	Mg [mg.l^{-1}]	P_{tot} [mg.l^{-1}]
Hněvkovice downstream of the dam												
c_{mean}	0.19	1.3	6.9	18.4	2.2	3.0	9.3	0.07	66	16.1	4.1	0.08
c_{90}	0.31	2.3	8.5	27.0	3.9	4.2	12.2	0.12	92	23.6	5.8	0.12
Kořensko LB												
c_{mean}	0.16	1.6	8.1	25.2	3.4	3.6	11.8	0.08	81	19.5	5.0	0.12
c_{90}	0.33	3.1	11.0	36	5.2	4.9	15.4	0.16	104	27.7	6.6	0.19
Kořensko RB												
c_{mean}	0.15	1.6	8.2	24.4	3.5	3.7	11.7	0.1	82	19.1	4.8	0.12
c_{90}	0.33	2.9	11.0	37	5.6	5.5	14.9	0.16	110	30	7	0.19
Kořensko average												
c_{mean}	0.15	1.6	8.2	24.8	3.5	3.7	11.8	0.09	81.4	19.3	4.9	0.12
c_{90}	0.33	3.0	11.0	36.5	5.4	5.2	15.2	0.16	107	28.9	6.8	0.19
Government Decree no. 61/2003 (as amended)												
c_{mean}	0.23	4.5	-	25	3.8	-	-	-	-	190	120	0.15
c_{90}	0.5	7	-	35	6	-	-	-	-	250	150	0.20

C.2.4.1.8. Expected water quality development

Although the quality of water in the Vltava River at Hněvkovice and at Kořensko complies with Government Decree no. 61/2003 (as amended) virtually in all indicators monitored, improvements can be expected for some of the indicators in the near future. This improvement can be achieved in 3 steps.

The first step, which is under way, consists in meeting emission standards C_{emis} stipulated by Government Decree No 229/2007 by all (recorded) point sources of pollution. Currently, there are 141 pollution sources recorded within the Summary Water Balance (SWB) records for the Vltava River basin upstream of Hněvkovice and 141 recorded pollution sources in the Lužnice River basin upstream of the Lužnice-Vltava confluence. Produced and discharged pollution in the main water quality indicators, as extracted from the completed SWB database, is given in the table below.

Table C.2.43: Pollution [$g.s^{-1}$] generated and discharged in the Vltava and Lužnice basins, 2007

	BOD_5	COD_{Cr}	SS	$N\text{-}NH_4^+$	N_{inorg}	N_{tot}	P_{tot}
Vltava upstream of Kořensko							
Generation	236.374	540.584	340.529	19.733	19.86	30.072	4.742
Discharge	6.357	36.607	7.599	5.066	10.306	12.555	0.677
Lužnice upstream of the Vltava - Lužnice confluence							
Generation	220.894	429.14	204.898	20.987	22.331	33.074	4.909
Discharge	7.499	30.024	7.645	3.293	9.289	11.464	1.045

The table below shows the calculated discharged pollution reduction which may be attained after the emission limits laid down by the Government Decree are complied.

Table C.2.38: Calculation of potential pollution reduction [$g.s^{-1}$] discharged into the Vltava and Lužnice basins as compared to 2007

	BOD_5	COD_{Cr}	$N\text{-}NH_4^+$	N_{tot}	P_{tot}
Vltava upstream of Kořensko					
Number of sources with $t.yr^{-1} > 0$	134	138	141	141	141
Number of towns/villages with $t.yr^{-1} > 0$	120	120	120	120	120
Number of towns/villages with exceeded c_{emis}	23	17	2	0	1
Potential decrease in $g.s^{-1}$	0.516	0.830	0.026	0	0.0046
Lužnice upstream of the Vltava-Lužnice confluence					
Number of sources with $t.yr^{-1} > 0$	137	139	142	142	142
Number of towns/villages with $t.yr^{-1} > 0$	124	124	124	125	124
Number of towns/villages with exceeded c_{emis}	55	39	0	2	3
Potential decrease in $g.s^{-1}$	1.231	1.809	0	0.370	0.0510

The second step in the chain leading to alleviation of the river basin pollution burden will consist in compliance with emission limits to be imposed on water users by water management authorities as of 1 January 2010 based on Government Decree no. 61/2003. According to that “combined” provision, the emission limits shall not only make for compliance with the emission standard stipulated by Government Decree no. 61/2003 (as amended) but also for compliance with the stipulated immission standards at all the 47 water centres on the Vltava upstream of Hněvkovice and 56 water centres on the Lužnice.

Compliance must be ensured not only with general immission standards (specified as c_{90} in Table 1, Annexe 3 to the Government Decree or as average levels in Table 4 of the applicable methodological guideline issued by the Department of Protection of Waters, Ministry of the Environment) but also with the more stringent immission standards pertaining to the various water uses, i.e. to drinking water production, swimming and protection of fish (cyprinids and salmonids) specified as the average levels in Table 1, Annexe 3 to the Government Decree.

Sites requiring water protection for water management purposes are specified in the Ministry of Environment Decree no. 137/1999 laying down a list of water management reservoirs and principles for the delimitation of and changes in protected water source zones and in the Ministry of Agriculture Decree no. 267/2005 amending the Ministry of Agriculture Decree no. 470/2001 laying down a list of important watercourses and procedures for the management of watercourses, as amended by Decree no. 333/2003.

Sites where water protection for swimming is required are specified in Decree no. 159/2003, specifying surface waters used for swimming.

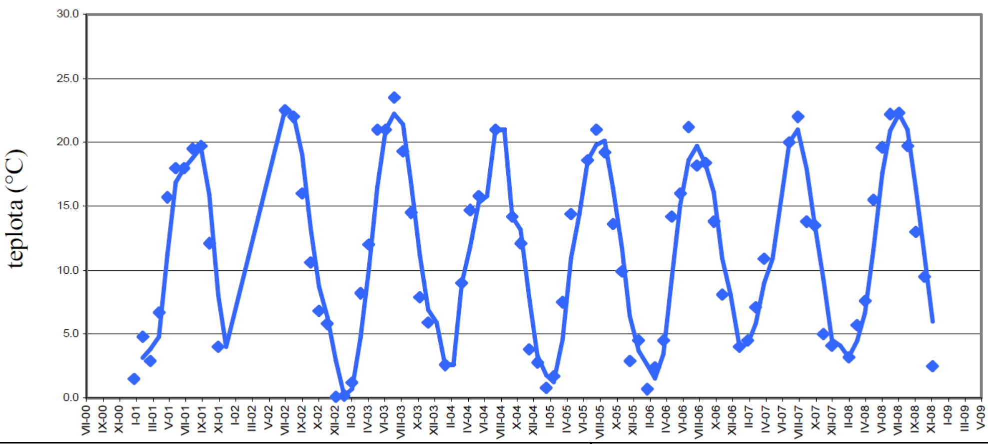
River segments to which the requirement of water protection for the life of cyprinids and salmonids applies are specified by Government Decree no. 71/2003 establishing surface waters which are suitable for the life and reproduction of indigenous species of fish and other aquatic fauna and determining and evaluating the quality of such waters.

The third (and most difficult) step towards a reduction of the river pollution burden will focus on non-point and diffuse pollution sources in the river basin(s).

C.2.4.1.9. Water temperature

The development of water temperature in the Vltava River at Hněvkovice downstream of the dam in the 2001-2008 period is shown in the graph below.

Figure C.2.70: Development of water temperature in the Vltava River at Hněvkovice downstream of the dam, 2001-2008



Teplota	Temperature

The lowest, highest and mean temperatures during that period were 0.1°C, 23.5°C and 11.4°C, respectively. During the past period of 2004-2008 the mean temperature was also 11.4°C, c_{90} was 21.0°C.

At the nearer site upstream of the mouth of the NPP Temelín wastewater duct at Kořensko (left bank), the mean temperature was 11.3°C and c_{90} was 21.7°C in 2004-2008. In comparison to the Hněvkovice site, water temperature at that site is still affected by the inflowing Lužnice River downstream of Týn nad Vltavou. It is clear that the temperatures in the Vltava River at Hněvkovice and at Kořensko are comparable. When assessed against Government Decree no. 61/2003 (as amended), the temperatures are significantly lower than the immission limit for c_{90}, 25°C, as well as than the corresponding mean temperature of 14°C.

C.2.4.2. Ground water

C.2.4.2.1. Current groundwater flows

NPP Temelín is sited on tableland. At the site and in its surroundings, supplies to the ground water come from filtered precipitation, and the ground water flows away from the site to all sides at relatively high level gradients.

Two spatially non-related ground water horizons exist in the plant area:

- a shallow circulation horizon at approximately 30-50 m depth under the ground, and
- a fissure water horizon at depths > 100 m under the ground.

Construction work during the erection of the existing plant, involving compaction of free areas, construction of buildings and superficial dewatering of the plant area, brought about a decrease in the filtering fraction of atmospheric precipitation making up the ground water, leading to a change in the ground water level in the plant area and in its nearest surroundings.

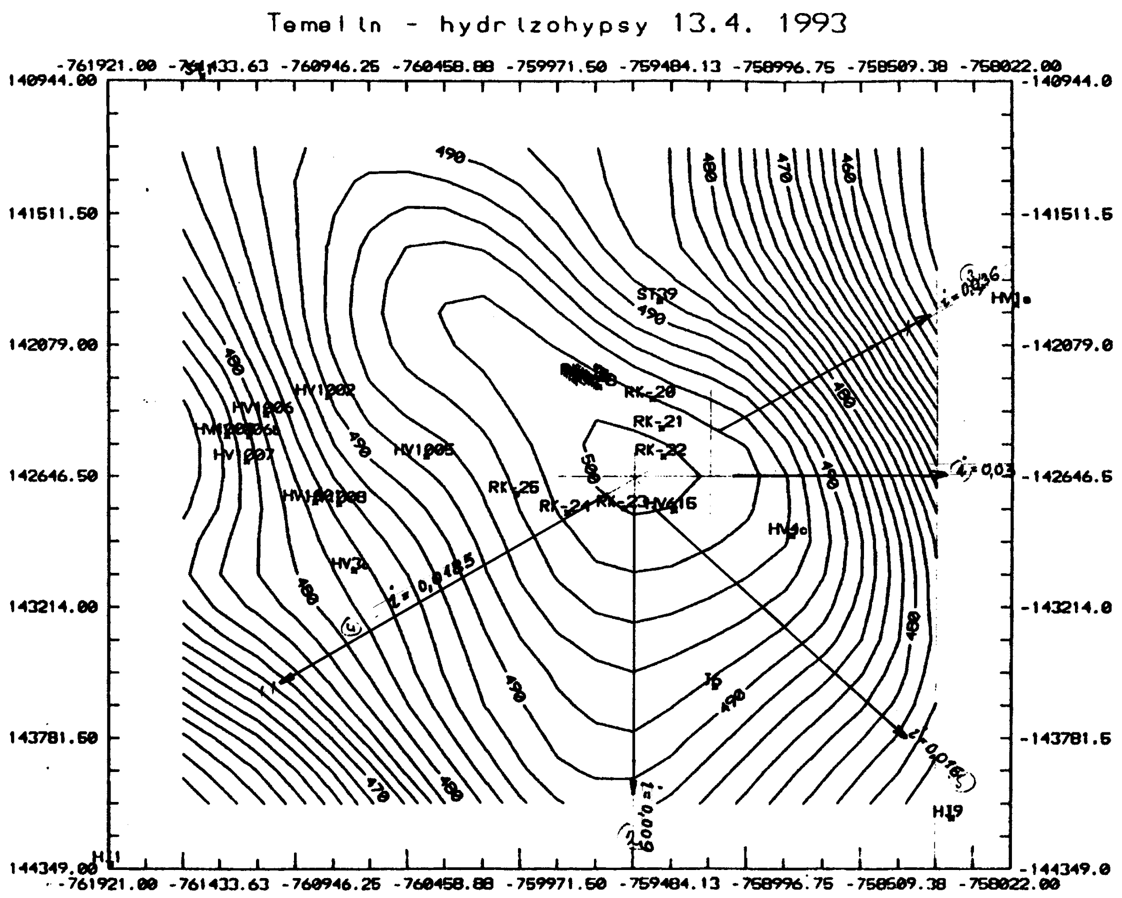
In the shallow ground water circulation horizon at depths up to 30-50 m, the aquified parts possess a low capacity. For this reason it is unfeasible that a high-capacity ground water withdrawal facility should be installed within the plant area: this may change the flow direction and affect substantially of the ground water regime.

C.2.4.2.2. Rock permeability, ground water flow parameters

The basic parameters of the rocks were examined by pumping tests within a hydrogeological survey (Anton Z., 1993, Dufek J., 1993). The transmissibility coefficient / permeation coefficient and ground water thickness values were the major parameter investigated. The permeation coefficients were calculated based on the transmissibility coefficients and the ground water thickness. They are typical parameters of the fissure-pore environment in this area. In agreement with this are the very large differences between the non-reduced and reduced permeability coefficient values. The non-reduced values refer to the drilled-in layer thickness whereas the reduced values refer to the inflow segments of the layer, established by well logging.

The ground water flow velocity was derived from the coefficients of permeability and ground water level slopes. The ground water slopes were derived from isohypse maps (see the layout below) and were calculated for the major ground water outflow directions away from the plant area.

Figure C.2.71: Isohypse map



Temelín – hydrozohypsy	Temelín - ground water table contours

Data for the ground water level development are given later in Section C.2.4.2.5, Ground water regime monitoring.

The permeation and true ground water flow velocities were calculated from the parameters of filtration and ground water level slopes. Effective porosity, needed to calculate the true velocity, was estimated by qualified assessment to $n_e = 0.04$.

The established data of the ground water level slope, coefficient of transmissibility, mean coefficient of permeability and calculated permeation and true ground water flow velocities are given in the table below.

Table C.2.45: Groundwater flow parameters

Area	Slope	Coefficient of transmissibility	Mean coefficient of permeability	Velocity	
				Permeation	True
		[x10^{-7} m^2.s^{-1}]	[x10^{-7} m.s^{-1}]		
Non-reduced data					
NPP area	0.009	59	3.8	0.0342	0.855
Northeast	0.036	1.1	0.016	0.00058	0.014
Southeast	0.016	1.3	0.021	0.00034	0.009
Southwest	0.018	51	1.9	0.0342	0.855
Mean value	x	x	x	x	0.431
Reduced values					
NPP area	0.009	59	40	0.36	9.00
Northeast	0.036	1.1	0.55	0.02	0.50
Southeast	0.016	1.3	1.3	0.021	0.525
Southwest	0.018	51	21.5	0.39	9.75
Mean value	x	x	x	x	4.943

Note: The non-reduced values refer to the drilled layer thickness whereas the reduced values refer to the inflow segments of the layer, established by well logging.

Determination of a mean true ground water velocity describing both the plant area and its nearest surroundings is problematic. The reduced velocities basically represent privileged pathways which, however, may not have a wide territorial validity. On the other hand, the porosity of the superincumbent layer may play a role despite the fact that the entire layer thickness is not involved in the ground water flow due to the non-homogeneity of the medium. The model radionuclide migration calculations used a mean value of $v_s = 2.68.10^{-7}$ m.s^{-1}, derived from the two mean permeation velocity values (i.e. 0.431.10^{-7} m.s^{-1} and 4.943.10^{-7} m.s^{-1}). In some cases a ground water flow velocity 10 times higher, i.e. $v_s = 2.68.10^{-6}$ m.s^{-1}, was considered (see later).

Apart from examination of the technological condition of the boreholes, well logging as a part of the hydrogeological survey was also used to identify disturbed and fissured zones and inflow areas. The amounts flowing into the boreholes were at levels of tenths to hundredths of litres per second, specific yields were from 3.3.10^{-5} m^3.s^1 to 17.0.10^{-5} m^3.s^{-1}.

C.2.4.2.3. Monitoring system

A ground water quality and regime monitoring system has been installed at the NPP Temelín site and in its nearest surroundings. The selection and location of the monitoring equipment agree with the presumed directions of ground water outflow away from the plant. The spatial monitoring network satisfies the following purposes:

- Identification of the ground water gradients in the plant surroundings
- Monitoring of ground water level (GWL) fluctuations
- Assessment of the possibility that the plant affects the ground water level
- Monitoring of the ground water quality
- Monitoring of the ground water activity
- Assessment of the impacts of the plant operation (including plant facilities) on the ground water
- Development of a basis for unexpected interventions in relation to ground water
- Development of underlying data for potential future construction of new facilities.

The locations and depths of the boreholes are specified below.

- Waste dumping site at Březí: 2 boreholes,
  - S1 and S2, 9 m deep, quality monitoring
- Waste dumping site at Knín: 4 boreholes,

- H1 to H4, 9 m deep, quality monitoring

- Temelínec dumping site: 12 boreholes,
  - HV 1001, 47 m deep, quality and GWL monitoring
  - HV 1002, 45 m deep, quality monitoring (plus GWL monitoring till 2001)
  - HV 1003, 44 m deep, quality and GWL monitoring
  - HV 1005, 45 m deep, quality and GWL monitoring
  - HV 1006, 10-15 m deep, quality and GWL monitoring till 1991 (GWL level monitoring since 2004)
  - HV 1007, 10-15 m deep, quality and GWL monitoring till 1991 (GWL monitoring since 2007)
  - HV 1008, 10-15 m deep, quality and GWL monitoring till 1991
  - HS3 to HS6, 12 m deep (monitoring since 2002)

- NPP Temelín area: 18 boreholes

  Boreholes within the NPP Temelín area serve ground water quality and level monitoring in the near vicinity of important structures and are categorised as follows:

  - RK 1 to RK 8, at the BAPP building, 15 m deep
    RK 1, quality monitoring in specific situations
    RK 2, GWL and quality monitoring
    RK 3, quality monitoring in specific situations
    RK 4, quality monitoring in specific situations
    RK 5, quality monitoring in specific situations
    RK 6, quality monitoring in specific situations
    RK 7, quality monitoring in specific situations
    RK 8, quality monitoring in specific situations
  - RK 20, at the CHNR (cooling tank with spraying) pools, 30 m deep
  - RK 21, at the chemicals storage building, 30 m deep, quality monitoring in specific situations
  - RK 22, under the Unit 1 diesel generator station building, quality monitoring in specific situations
  - RK 23 to RK 25, behind the unit 1 turbine hall in the direction of the ground water flow towards the Temelínec dumping ground, 30 m deep
    RK 23, GWL and quality monitoring in specific situations
    RK 24, quality monitoring in specific situations
    RK 25, GWL and quality monitoring
  - RK 26, near the spent fuel storage facility, 20 m deep, quality and GWL monitoring (monitoring since 2006)
  - HV 615, at the cooling towers, 47 m deep, quality and GWL monitoring
  - PV 50 and PV 51, at the petroleum substances storage facility, 17 m deep, quality monitoring

- Monitoring boreholes in the plant surroundings, 12 boreholes

  The boreholes were drilled for ground water monitoring in the plant surroundings. They are not directly linked to the individual NPP systems, they are important, however, for the monitoring and subsequent evaluation of any impacts of the plant operation on ground water in the surroundings. The boreholes inform about deep, medium and shallow ground water circulation in the plant surroundings. Long-term monitoring of the boreholes, even before the plant start-up, allows the impacts of the plant operation to be objectively evaluated.

  - HV 1A, 100 m deep, quality and GWL monitoring
  - HV 2B, 100 m deep, quality and GWL monitoring
  - HV 3A, 95 m deep, quality and GWL monitoring
  - HV 3B, 50 m deep, GWL monitoring
  - HV 3C, 25 m deep, quality and GWL monitoring
  - HV 4A, 100 m deep, GWL and quality monitoring in specific situations
  - HV 5A, 130 m deep, quality and GWL monitoring
  - HV 5C, 30 m deep, quality and GWL monitoring
  - HV 6C, 40 m deep, quality and GWL monitoring
  - ST 38 and ST39, wells in Křtěnov, quality and GWL monitoring
  - HJ 1, Kočín, GWL and quality monitoring in specific situations

Figure C.2.72: Monitoring borehole sites

C.2.4.2.4. Ground water regime monitoring

The following ground water regime development was found by periodical monitoring throughout the 1991-2008 period.

Table C.2.39: Summary information on ground water level at the NPP Temelín site and in its surroundings, 1991-2000

Borehole	Water level and ground altitudes [m above sea level]					
	Maximum	Minimum	Mean	Amplitude [m]	Ground	Mean depth under the ground [m]
HV 1001	487.72	485.33	486.12	2.39	487.79	1.67
HV 1002	500.53	498.03	499.61	2.50	501.37	1.76
HV 1003	465.59	464.39	464.91	1.20	463.83	-1.08
HV 1006	475.31	470.81	474.43	4.50	479.44	5.01
HV 1007	473.51	470.91	472.07	2.60	473.58	1.51
HV 1008	488.40	486.43	487.48	1.97	487.90	0.42
RK 2	502.25	499.51	500.81	2.74	507.15	6.34
RK 23	501.69	497.47	499.92	4.22	507.35	7.43
RK 25	497.66	496.1	496.94	1.56	503.35	6.41
RK 26	Monitoring since 2006					
HV615	502.31	499.97	501.35	2.34	507.62	6.27
HV 1A	442.75	438.85	441.59	3.90	442.63	1.04
HV 2B	480.9	480.25	480.57	0.65	479.95	-0.62
HV 3A	480.27	477.36	478.83	2.91	483.76	4.93
HV 3B	481.94	479.42	480.66	2.52	485.10	4.44
HV 3C	482.50	480.76	481.60	1.74	484.42	2.82
HV 4A	495.11	493.43	494.48	1.68	496.12	1.64
HV 4C	496.63	484.15	495.14	12.48	497.47	2.33
HV 5A	495.11	492.26	494.18	2.85	494.78	0.60
HV 5C	494.24	491.3	492.96	2.94	494.78	1.82
HV 6C	483.54	482.74	483.30	0.80	485.36	2.06
ST 38	486.74	485.41	486.36	1.33	488.10	1.74
ST 39	483.02	482.1	482.44	0.92	485.11	2.67
HJ 1	439.99	438.56	439.40	1.43	439.64	0.24

During the pre-operational years (1991-2000), the mean ground water level was between 7.43 and 0.24 m under the ground. In the boreholes HV 2B and HV 1003, the mean level reached above the ground.

Table C.2. 40: Summary information on the ground water level at the NPP Temelín site and in its surroundings, 2001-2008

Borehole	Water level and ground altitudes [m above sea level]					
	Maximum	Minimum	Mean	Amplitude [m]	Ground	Mean depth under the ground [m]
HV 1001	486.77	484.85	485.93	1.92	487.79	1.86
HV 1002	Monitoring discontinued					
HV 1003	464.57	464.11	464.34	0.46	463.83	-0.51
HV 1006	Monitoring was discontinued and renewed again in 2004 to comply with legislation					
HV 1007	Monitoring discontinued, GWL measurement was renewed again in 2007					
HV 1008	Monitoring discontinued					
RK 2	502.75	499.92	501.08	2.83	507.15	6.07
RK 23	502.70	499.17	500.59	3.53	507.35	6.76
RK 25	498.01	496.79	497.37	1.22	503.35	5.98
RK 26	498.48	497.64	498.14	0.84	502.05	3.91
HV615	503.14	500.83	502.26	2.31	507.62	5.36
HV 1A	443.68	440.43	442.62	3.25	442.63	0.01
HV 2B	481.55	480.13	480.93	1.42	479.95	-0.98
HV 3A	480.89	477.29	479.41	3.61	483.76	4.35
HV 3B	482.14	478.97	480.41	3.17	485.10	4.69
HV 3C	482.61	480.33	481.22	2.28	484.42	3.20
HV 4A	495.17	493.37	494.38	1.80	496.12	1.74
HV 4C	496.66	489.88	495.01	6.78	497.47	2.46
HV 5A	494.98	489.42	494.17	5.56	494.78	0.61
HV 5C	494.54	490.93	493.03	3.62	494.78	1.75
HV 6C	483.66	482.25	482.98	1.41	485.36	2.38
ST 38	486.62	485.13	485.77	1.49	488.10	2.33
ST 39	484.34	481.81	483.21	2.53	485.11	1.90
HJ 1	439.94	439.14	439.76	0.80	439.64	-0.12

Deeper horizon

In the area of the Temelín hill the deeper-horizon ground water lies approximately 100 m under the ground Levels in the boreholes are slightly strained, with levels above or below the ground, and represent the situation of deep circulation systems.

The deep circulation system levels have a balanced tendency and the regime of this system is more dependent on regional conditions than on local conditions in the plant area. On the contrary, the hydrograms suggest that through its pressure, the drilled deep system affects the levels of underground boreholes in the area.

The shallow system

In comparison to the situation prior to the NPP operation, the mean ground water levels of the shallow circulation system in the plant area increased by 0.27-0.91 m, in accordance with the higher mean total precipitation, despite the fact that ground water is pumped out through draining boreholes in this area.

The mean shallow circulation system ground water levels in the monitoring boreholes in the plant surroundings and in some boreholes in the Temelínec dumping ground area lay up to 1 m lower during the 2001-2008 period than in the pre-operational period. The descending tendency of the ground water level is apparent at sites where ground water enters the ground through small water leaks, e.g. at the Temelínec dumping ground site. A slightly descending tendency of the ground water levels is also observed in the area of the monitoring boreholes to the northwest of the plant, where no such leaks occur. The proportion of recharge from precipitation, or the underground outflow, decreased during the most recent year of observation and affected the overall trend of levels in the plant surroundings. Based on the above facts, the ground water regime is affected slightly by the draining of the plant area. However, the contribution of the draining of the surface to this effect cannot be ascertained.

Drainage boreholes and ground water regime development

Drainage boreholes were drilled in the plant area during the pre-operational period with a view to lowering the ground water level at buildings whose foundations lie below that level. The effect of draining became apparent for boreholes HV 615, RK 2 a RK 23 after they were made operable in the 1990s. The draining process is controlled in dependence on the set ground water level height, owing to which the level stabilised in the late 1990s. Hydrograms and water balance in the area reveal a dependence of the ground water regime on natural conditions and on the total amounts of precipitation.

As mentioned above, the ground water level in the plant area is stabilised during the operational period. A slight level decreasing tendency has been observed in the nearest plant surroundings. This is apparently due to the combined effect of ground shaping, drainage facilities within the plant area and variability of the total amounts of precipitation in the region.

C.2.4.2.5. Ground water quality monitoring

Focus is on two aspects: (i) potential effect of the NPP and (ii) natural ground water quality in the area. An effect of the NPP operation on the ground water quality is primarily assumed during the assessment. If no effect of the operation is demonstrable, then the ground water quality is determined by natural conditions, i.e. the geologic environment, ground water flow velocity, atmospheric precipitation quality, and other factors, such as agricultural management of land in the plant surroundings.

Long-term ground water quality monitoring in the plant area and its surroundings, including dumping ground no. 6 at Temelínec, has not revealed any significant quality changes brought about by the nuclear power plant operation. The indices fluctuate about long-term averages and do not follow any clear trend. Analysis of the parameters leads to the conclusion that the ground water quality is unaffected by normal operation of the plant. In general, the variability of the indicators can be ascribed to the composition of the geologic environment, rainwater quality and ground water flow velocity. Agricultural land uses may play a role as well.

The COD_{Mn} data at the central storage facility for petroleum substances are consistent with those in the other boreholes. The NEL levels lie consistently below the limit of detection. Storage of petroleum substances has no impact on the ground water quality.

The closed waste disposal sites at Březí and Knín, which initially served the plant, have no impacts on the ground water quality either. Ground water quality in the area is determined by natural conditions and, perhaps, by agricultural land uses.

C.2.4.2.6. Ground water radioactivity

Specific radioactivity monitoring in the plant area and in its nearest surroundings did not reveal any significant change indicating a significant long-term effect of the nuclear power plant on the ground water activity. Specific activities of tritium and caesium 137 lay below their limits of detection.

C.2.5. Soil

C.2.5.1. Soil parameters

Soil in the area where the NNNP reactors should be built consists of a humus layer approximately 20 cm thick, which will have to be removed prior to the construction and subsequently used within land reclamation procedures. The original soil types in the plant surroundings were disturbed by overburden removal and subsequent backfilling. Thus the soils can be described as anthropically affected soils. From among soils with an anthropic A-horizon on a man-made bedrock, the degradation anthro-soil (built-up land plots) and typical anthro-soil (soil with initial development on man-made substrates enabling the growth of vegetation) subtypes are present.

The specific soil properties are determined based on the Ministry of Agriculture Decree no. 327/1998, establishing the characteristics of Valuated Soil-Ecological Units (VSEU) and procedures applying to their registration and updating. The Valuated Soil-Ecological Unit codes provide information on the climate region, main soil unit, slope and exposure of the plot and soil skeleton.

The soils at the construction site are only partly characterised as VSEU. The codes are mainly assigned to the areas planned for the construction site facilities.

Table C.2.41: Characteristics of soils by main types

Ecological unit	Protection class	Main soil unit	Soil type
55001	III	50	Gleyified cambisoils and modal pseudogleys on granite, gneiss and other solid rocks (which are not in HPJ 48, 49), medium heavy, weakly to medium skeletal, with a tendency to temporary wetting. *This soil type is mainly present on the B1, B2, D and E plots for the NNPP construction site facilities and on the construction site area for power output.*
55011	III		
52901	II	29	Modal eubasic to mesobasic cambisoils including weakly gleyified varieties, on gneiss, mica schist, phyllite, and granite, medium heavy to lighter medium heavy, without skeleton to medium skeletal, with predominantly good moisture conditions. *This soil type is mainly present on the B2, D and E plots for the NNPP construction site facilities.*
52911	II		
53214	V	32	Modal eubasick to mesobasic cambisolis on coarse weathered rocks, permeable substrates low in minerals, granite, syenite, granodiorite, to a lesser extent on orthogneiss, lighter medium heavy with an higher gruss content, favourable from the moisture aspect in a humid climate. *This soil type is present on the C and E plots for the NNPP construction site facilities.*
53755	V	37	Lithic cambisoils, modal cambisoils, ranker cambisoils and modal rankers on solid substrates without discrimination, in the layer below the arable layer: from 30 cm strongly skeletal or with a solid rock, weakly to medium skeletal, in the arable layer: lighter medium heavy to light, mainly drying, dependent on atmospheric precipitation. *This soil type is present on the B1 plot for the NNPP construction site facilities.*
54710	III	47	Modal pseudogleys, luvic pseudogleys, gleyified cambisoils on steep (polygenetic) earth, medium heavy, the bottom parts heavier to medium skeletal, with a tendency to temporary wetting. *This soil type is present on the C plot for the NNPP construction site facilities.*
56841	V	68	Modal gleys and modal paludified gleys, histic gleys, gleyified paludified phaeozems on alluvial plains in the vicinity of minor watercourses, soils of narrow depressions including slopes, difficult to categorise, medium heavy to very heavy, unfavourable water regime. *This soil type is present on the C plot for the NNPP construction site facilities.*
54078	V	40	Soils on slopes steeper than 12 degrees, cambisoils, rendzinas, pararendzinas, rankers,

			regozems, chernozems, brownearth and other types, medium heavy, medium light to light, with different degree of skeleton, moisture dependent on climate and exposure. *This soil type is mainly present on the C plot for the NNPP construction site facilities.*
57311	V	73	Gleyified cambisoils, gley-type and hydroelluvial pseudogleys, hydroelluvial and superficial gleys lying on slopes, mostly wet with the occurrence of slope springs, medium heavy to very heavy, up to medium skeletal. *This soil type is present on the E plot for the NNPP construction site facilities.*

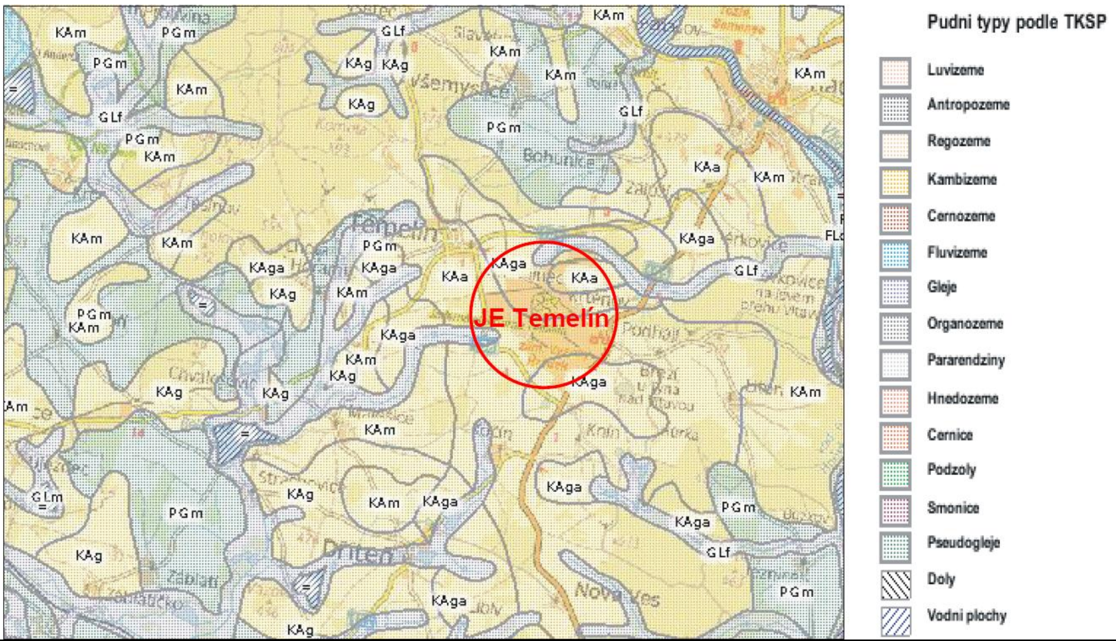
In the study area, brown soils, or cambisoils (HP or KA in the Czech soil classification system) predominate. They are the prevailing or most widespread soil types in the Czech Republic. The varieties include gleyified cambisoil (KAg) and pseudogleys, modal, or typical, cambisoil (KAm), acid mesobasic cambisoil (KAa) and ranker cambisoil (KAs).

Cambisoil (KA) This includes soils with a cambic brown horizon, mainly developed in the main series of strata of magmatic rocks, metamorphic rocks and compacted sedimentary rocks, as well as the corresponding series of strata, e.g. in non-compacted medium light to medium heavy sediments. The soils are mainly formed in the sloping conditions of hills, and also, to a minor extent, in plains. Cambisoils are present in the temperate humid climate zone, especially under broad-leaved forests.

Pseudogley (PG) The soils are characterised by the occurrence of a marked marble, redoximorphic diagnostic horizon. They are formed either from pedogenically (from luvisoils) or lithogenically stratified or impermeable (pelic, sand-clay) substrates. Pseudogleys are eubasic soils in the Bm horizon, with an elevated abundance of amorphous FeO. The occurrence of oligobasic pseudogleys is admitted.

Gley (GL) Gleys are most affected by ground water, which is present at small depths under the ground. The seeping ground water brings about atmospheric oxygen deficit in gleys, inducing reduction processes in the soil profile, involving trivalent iron reduction to divalent iron. This is why the gley horizon Gr is marked with green-blue or ochre-grey colour and conspicuous spots. The Gr horizon is plastic in wet conditions and very compact in dry conditions.

Figure C.2.73: Soil map using the taxonomic soil classification system (TSCS)



Půdní typy podle TKSP	Soil types according to TKSP (Czech Soil Taxonomic Classification System)
Luvizeme	Albeluvisols
Antropozeme	Technosols
Regozeme	Arenosols

Kambizeme	Cambisols
Cernozeme	Chernozems
Fluvizeme	Fluvisols
Gleje	Gleysols
Organozeme	Histosols
Pararendziny	Calcic Leptosols
Hnedozeme	Haplic Luvisols
Cernice	Phaeozems
Podzoly	Haplic Podzols
Smonice	Vertisols
Pseudogleje	Gleyic Stagnosols
Doly	Mines
Vodní plochy	Water bodies
JE Temelín	NPP Temelín

The soil protection class pursuant to the Guidelines of the Ministry of the Environment on the removal of land from the agricultural land fund is also determined based on the VSEU. In terms of the VSEU codes, none of the plots is categorised as agricultural land protection class I. They are categorised as protection class II to protection class V. The agricultural land protection classes are described as follows:

Class I — This agricultural land class includes best quality soils in the various climate regions, mainly in plains or on slightly sloping ground. Such land may be only exceptionally removed from the agricultural land fund, especially for environmentally friendly landscape remediation projects or for linear structures of fundamental importance.

Class II — This class includes agricultural land possessing a production capacity above the average within each climate region. From the agricultural land fund protection aspect the soils are highly protected, only conditionally removable, and from the territorial planning aspect, conditionally usable for building purposes.

Class III — This soil protection class encompasses soils in the various climate regions displaying an average production capacity. The soils are covered by a medium protection status and may be included in territorial plans for building purposes.

Class IV — This soil protection class comprises soils with a largely below-average production capacity within their climate regions, enjoy limited protection only and may be used for building purposes.

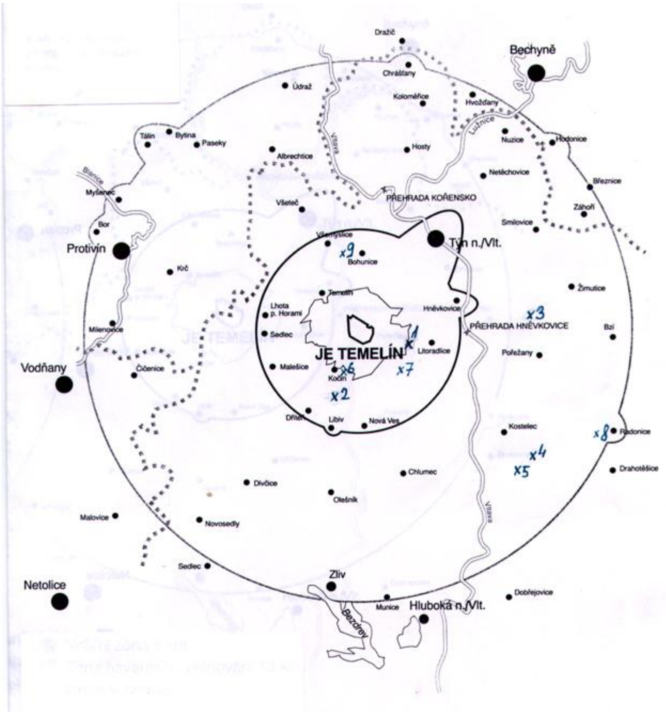
Class V — This soil protection class includes the remaining valued soil-ecological units, with soils possessing a very low production capacity. including shallow soils, very sloping soils, hydromorphic, gravel to stony soils and soils most endangered by erosion. They mostly constitute agricultural land which can be missed from the agricultural aspect. Their use for purposes other than agriculture may be more beneficial. They are mostly soils with a low degree of protection, except if located in protection zones and protected areas or if being of other interest from the environmental protection aspect.

C.2.5.2. Soil quality

Periodic annual monitoring concentrating on the quality of agricultural and forest land in the surroundings of the NPP has been under way since 2000 within the project of monitoring and assessment of the NPP Temelín environmental impacts. This monitoring was based on soil sampling and analysis in the spring and autumn seasons. In view of the fairly steady weather conditions, samples have been taken in autumn only since 2007. The selection of the soil parameters to be examined and analysed were refined on an ongoing basis taking into account past results and current needs.

Nine sampling sites have been selected to describe the soil properties in the plant surroundings. The sites were selected so as to cover all directions in the plant surroundings, including the prevailing wind direction. A detailed pedological study of the sampling sites was developed in 2002, including descriptions of the soil profiles, their signatures, quality and grain sizes of the genetic horizons. Attention was focused on cultivated meadows and sites representing forests when selecting the sampling sites.

Figure C.2.74: Schematic map showing the sampling sites



JE Temelín	Temelín NPP

1. Březí	Permanent grass in a close vicinity to the plant area, 1 km to the east. This is an extensively cultivated meadow with gardens of former family houses in Březí, Podhájí direction.
2. Dříteň	Permanent grass on a mild slope above the village of Dříteň, in a forest 4 km southwest of NPP Temelín.
3. Horní Kněžeklady	Permanent grass near a forest on a plateau approximately 7 km east of NPP Temelín.
4. Kostelec	Extensive permanent grass in a terrain depression towards the nearby forest approximately 10 km southwest of NPP Temelín.
5. Kostelec	Spruce forest, direction from the plant roughly the same as the meadow (a little bit more to the south) and distance from the plant about 1 km shorter, i.e. approximately 9 km.
6. Litoradlice	Permanent grass on a meadow approximately 3 km south of the plant, component of an extensive meadow complex on the left side of the Týn nad Vltavou - České Budějovice highway.
7. Litoradlice	Spruce forest, approximately 3.5 km southeast of the plant.
8. Radonice	Permanent grass, culture meadow approximately 12.5 km southeast of the plant.
9. Všemyslice	Permanent grass, meadow approximately 3 km north of the plant, component of a large complex of meadows.

In order to record the reference condition of the soils and any subsequent changes, such soil parameters were selected that are capable of responding to external stimuli in real time (or in the medium-time horizon at least) and, at the same time, are usable for the assessment of system changes in the environment.

Indicators were selected characterising:

- The organic moiety in the soil (balance of carbon, its fractions and microbial activity of the soil): total organic carbon in the soil, humus substances, fulvo-acids, humic acids, active soil carbon, water-soluble soil carbon, degree of humification, pH,
- The most labile forms of soil nitrogen: mineral and potentially mineralisable soil nitrogen
- Biological soil activity: carbon in the biomass of microorganisms, basal respiration, Hendrix' index
- Soil pollution with selected hazardous elements: Cd, As, Hg, Be, Cs, ^{137}Cs, ^{134}Cs, ^{7}Be, ^{214}Pb
- Phytocoenological relations.

Evaluation of the results must be based on data from reasonably long time periods of climate conditions and any agrotechnical interventions. Such activities associated with extensive cultivation of the test sites appear to constitute the main factor of the assessment. This applies, in particular, to the assessment of the carbon balance, biological activity of the soil and balance of the mineral species of soil nitrogen. Those 3 groups make up a mutually linked system which, although amenable to the effect of changes of external conditions (particularly humidity, temperature and weather) may be impacted much more substantially by way of farming. This was seen particularly at sites which have been cultivated quite extensively recently and whose many indicators were displaced towards higher levels. The test sites indicate some variations in the organic moiety of the soil. Associated with the decrease in carbon is the dying-away enhanced mineralisation effect, which is mainly due to the relatively dry autumn seasons during the recent years.

Microbial activity measured through the amount of organism biomass exhibited a slightly decreasing trend. However, this parameter exhibited a slight increase during the past year, accompanied by a slight growth of respiration activity. This was mirrored in a lower specific respiration at few sites only. This phenomenon is closely related to the increased primary matter supply.

No substantial variations in the annual levels of the various mineral nitrogen species or appreciable extremes in the time series were recorded. The slight mineral nitrogen increase in 2008 can be ascribed to the slightly more humid year and, at some sites, to animal fertilisation.

The situation is somewhat different as regards the assessment of both the heavy metal contents and their chemical species. Although they can be affected, e.g., by transformations especially of the primary organic matter, they are difficult to evaluate due to their generally low concentrations. The stagnation of the beryllium contents is the only phenomenon worth noting.

The situation is similar in the assessment of the monitored radionuclides, where any appreciable deviation from the long-term averages would be due to an emergency event. The ^{137}Cs radioactivity development in the time series, or of the mean levels of the radioactivity, exhibit a decreasing trend, particularly at sites where the radioactivity was initially rather high.

When making a comprehensive assessment of the development of the various soil parameters in the time series, no clear-cut adverse trend that can be related to the NPP operation has been detected. In conclusion, NPP Temelín operation has so far had no impact on the soil in the surroundings of the facility.

C.2.6. Rock environment and natural resources

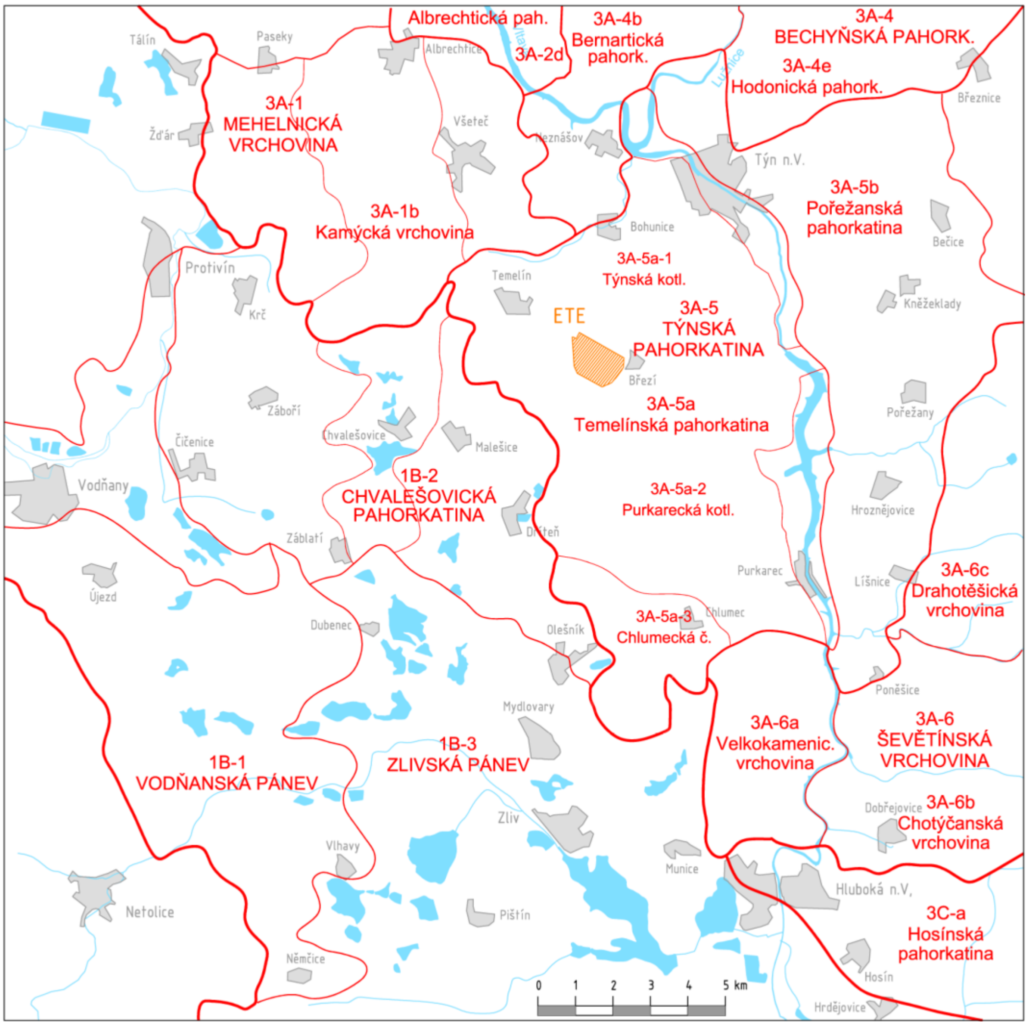
C.2.6.1. Geomorphological description of the area

From the geomorphological categorisation aspect (Demek, Mackovič et al. 2006), the Temelín region falls in the following units:

Province: Bohemian Massif
Subprovince: Bohemian-Moravian System
Region: Central Bohemian Hilly Land
Unit: Tábor Hilly Land
Subunit: Písek Hilly Land
District: Týn Hilly Land

The new nuclear installation construction site is located within the Týn Hilly Land area. In the regional categorisation of the current relief, the Týn Hilly Land District is divided into 2 subdistricts; the Temelín Hilly Land Subdistrict and the Pořežany Hilly Land Subdistrict.

Figure C.2.75: Regional relief patterns at the NPP Temelín site (scale: 1:200,000)



The Temelín Hilly Land is characterised by a predominantly integral erosion-denudation relief, segmented along the Vltava River, with extensive plain surfaces in the divide areas (altitude typically 480 to 510 m above sea level). The construction site for the NNPP Temelín reactor units lies on one of the plateaux at an altitude of 507 m above sea level.

C.2.6.2. Geological situation

C.2.6.2.1. Geology in the wide surroundings

The existing NPP Temelín and the new nuclear installation construction site are located in the southern part of the Bohemian Massif, in an area which is part of the Moldanubicum. Since the Mesozoic era, the geologic and tectonic development of this region has been affected by the neighbouring Alpine orogeny. Its various phases were mirrored by the tectonic activity of significant fault systems of the platform edge, thereby affecting the creation and development of the basin structures in South Bohemia. The basins were formed in a region where 2 fault systems important for the Moldanubicum intersect; the Blaník system, NNE-SSW direction, and the Jáchymov system, NW-SE direction. The activity of those systems stimulated the creation of important basin structures, thus enabling the paleogeographic extension of the cretaceous and tertiary sedimentation.

The crystalline foundation of this region is formed by the Moldanubian complex, represented here by the 2 lithofacial units - the monotonic and multi-varied series. The structure of the crystalline complex of the Moldanubicum was plastically and ruptually formed in several phases till the end of the Paleozoic, older structures being repeatedly activated and reformed.

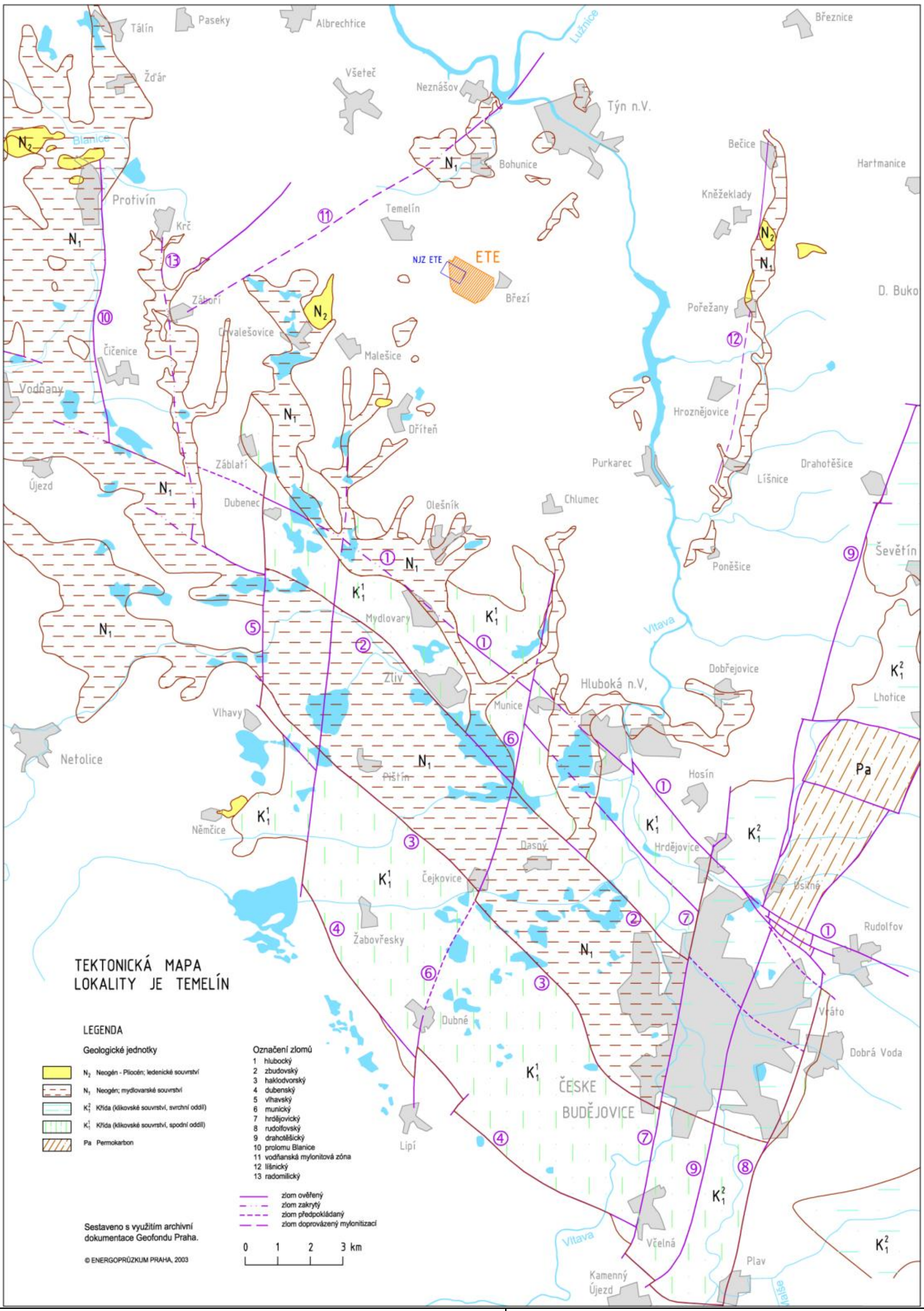
The most widespread rocks include biotitic, biotitic-sillimanitic to biotitic-cordieritic paragneiss and migmatites, occasionally with inserts of quartzites, amphibolites, granulites and orthogneiss. Those metamorphites are products of a complex polyphase deformation of the cover nature of both the Cadomian and Hercynian metamorphic and deformation cycles.

The Hercynian deep reactivation of the older substrate also brought about intrusion of granitoid massifs, accompanied by extensive migmatitisation. Numerous protrusions of the Central Bohemian pluton, represented by melanocratic amphibolitic-biotitic syenites in the surroundings of Písek, Protivín and Vodňany, penetrate through the sheath of the Moldanubian metamorphites in the north of the South-Bohemian region. The Ševětín granodiorite is an offshoot of the central Moldanubian pluton in the bedrock and at the western edge of the Třeboň basin.

The subsequent tectonic development of the South-Bohemian region was affected by both of the important fault systems, the Blaník system, NNE-SSW direction, and the Jáchymov system, NW-SE direction. The 2 fault systems were founded no later than the final phases of metamorphosis of the Moldanubicum and affected significantly the formation and development of the platform cover of the region.

In the South-Bohemian region, the Blaník system faults include particularly the Drahotěšice fault. Not only the Drahotěšice fault but also faults parallel to it, such as the Rudolfov, Hrdějovice and Munice faults, played a substantial part in the tectonic development of the Budějovice basin. In the Budějovice basin, the system of faults in the NW-SE direction is mainly represented by the Hluboká fault. The Zbudov and Haklův Dvůr faults are also important.

Figure C.2.76: Tectonic map (1:200,000) of the NPP Temelín site showing important faults and sedimentary formations of the Permian, Cretaceous and Tertiary periods



ETE	Temelín PP
Tektonická mapa lokality JE Temelín	TECTONIC MAP OF NPP TEMELÍN LOCALITY
LEGENDA	LEGEND
Geologické jednotky	Geological units
N_2 Neogén – Pliocén; ledenické souvrství	N2 Neogene - Pliocene; Ledenice Series

N1 Neogén; mydlovarské souvrství	N1 Neogene; Mydlovary Series
K12 Křída (klíkovské souvrství, svrchní oddíl)	K12 Cetraceous Period (Klíkovské Series, top section)
K12 Křída (klíkovské souvrství, spodní oddíl)	K12 Cetraceous Period (Klíkovské Series, bottom section)
Pa Permokarbon	Pa Perm-Carboniferous Period
Označení zlomů	Identification of faults
1 hlubocký	1 hlubocký
2 zbudovský	2 zbudovský
3 haklodvorský	3 haklodvorský
4 dubenský	4 dubenský
5 vlhavský	5 vlhavský
6 munický	6 munický
7 hrdějovický	7 hrdějovický
8 rudolfovský	8 rudolfovský
9 drahotěšický	9 drahotěšický
10 prolomu Blanice	10 Blanice gorge
11 vodňanská mylonitová zóna	11 Vodňany mylonite zone
12 líšnický	12 líšnický
13 radomilický	13 radomilický
zlom ověřený	verified fault
zlom zakrytý	hidden fault
zlom předpokládaný	assumed fault
zlom doprovázený mylonitizací	fault accompanied by mylonisation
Sestaveno s využitím archivní dokumentace Geofondu Paha	Compiled using archived documentation of Geofond Prague

The appreciable tectonic activity of the above fault system was particularly apparent in the periods of Stefan C and lower Autun and then in the Coniac and lower Santon, when this region was highly mobile and the formation of the tectonic depressions made the formation of continental Permian-Carboniferous sediments (tectonically limited blocks) possible in the elongated structure of the Blaník furrow and, in the Mesozoic, of sediments of the Klikov complex of strata in two centres, the Budějovice and Třeboň basins. The thickness of the lower part of the Klikov system of strata reached up to 340 m.

The calming and slow rising of the southern part of the Bohemian Massif, which occurred in the Santonian and was accompanied by denudation and peneplenisation, died away first in the lower Miocene (Ottnang), when a tectonically limited depression exceeding the boundaries of the Senonian basins was formed in the South-Bohemian region. The end of the lower Miocene was associated with an additional rejuvenation of the relief and development of fluvial-lacustrine sediments of the Mydlovary system of strata. Tertiary sedimentation in the southern part of the Bohemian Massif was terminated in the Pliocene by fluvial-lacustrine sedimentation of the Ledenice system of strata.

The Paleogeographic structure of the various groups of strata demonstrates unambiguously that the decrease of the whole foreland, the basin area itself and the surrounding periphery nearly or entirely to the Parathetys sea level was a necessary precondition for their sedimentation. The simultaneous laying of the superincumbent formations was affected subsequently by the tectonic activity of the various fault systems.

The arching and lifting motions of some blocks (Blanský les, Novohradské Hory and Novobystřice Hilly Land) during the upper Pliocene brought about a significant change in the river system of draining: draining to the south was discontinued and draining to the north started. The Paleo-Vltava then played a dominant role in the completion of the morphology of the southeastern part of the Budějovice basin, the Paleo-Blanice in the northwestern part, and the Paleo-Lužnice in the Třeboň basin. Strong denudation of the sediments of the Ledenice group of strata and of the Miocene sediments of the basin filling was another consequence. The weakening lifting tendencies continued in the old Pleistocene, as did additional denudations of the sedimentary filling of the Budějovice basin and deepening of the valley network in the Písek Hilly Land area, which started to form as a marked elevation with respect to the basin.

The stepwise carving-down of the Vltava valley in the upper Pliocene and in the Pleistocene was accompanied by the formation of river terraces (2 Pliocenic, 6-7 Pleistocenic); only the Mindelian and Rissian are through-going in some segments (České Budějovice basin, Purkarec and Týn cauldrons). The surfaces of the Pliocene levels lie at 62-73 m, Quaternary about 50 m (Donau?) or 40 m (Günz?) above the level of the Vltava. Those figures document the extent of erosion of the Vltava in the periods. The Dolní Blanice is accompanied by 2 low terraces (relative height up to 10 m), presumably of Rissian or Mindelian age. The calming of the Cretaceous and Neogenous sediments of the basin continued in the Quaternary, when extensive flat surfaces were formed, at heights matching the low (Rissian) terraces or the surfaces of the valley plains.

The current morphology of the South-Bohemian region, including the NPP Temelín site, is thus a result of a long geologic development, to which tectonic, sedimentation and erosion phenomena have contributed. Alpine folding played a major part in the development of the South-Bohemian region. Its phases were mirrored by the tectonic activity of the Hercynian and older fault systems of the Bohemian Massif edge. The various phases of activation of the faults, giving rise to inverse, largely vertical motions, were accompanied by the formation of the Senonian, Palaeogenic, Miocene and Pliocene sedimentation. While the Senonian sediments were tectonically disturbed by vertical motions on faults at orders of a magnitude of hundreds of metres (up to 300 m), Miocene and Pliocene sedimentations developed in conditions of tectonic activity of a regional nature, without significant vertical motions at the faults. The weakening tectonic activity in the Pleistocene manifested itself mainly in the south (in the frontier mountains) and died away towards the north.

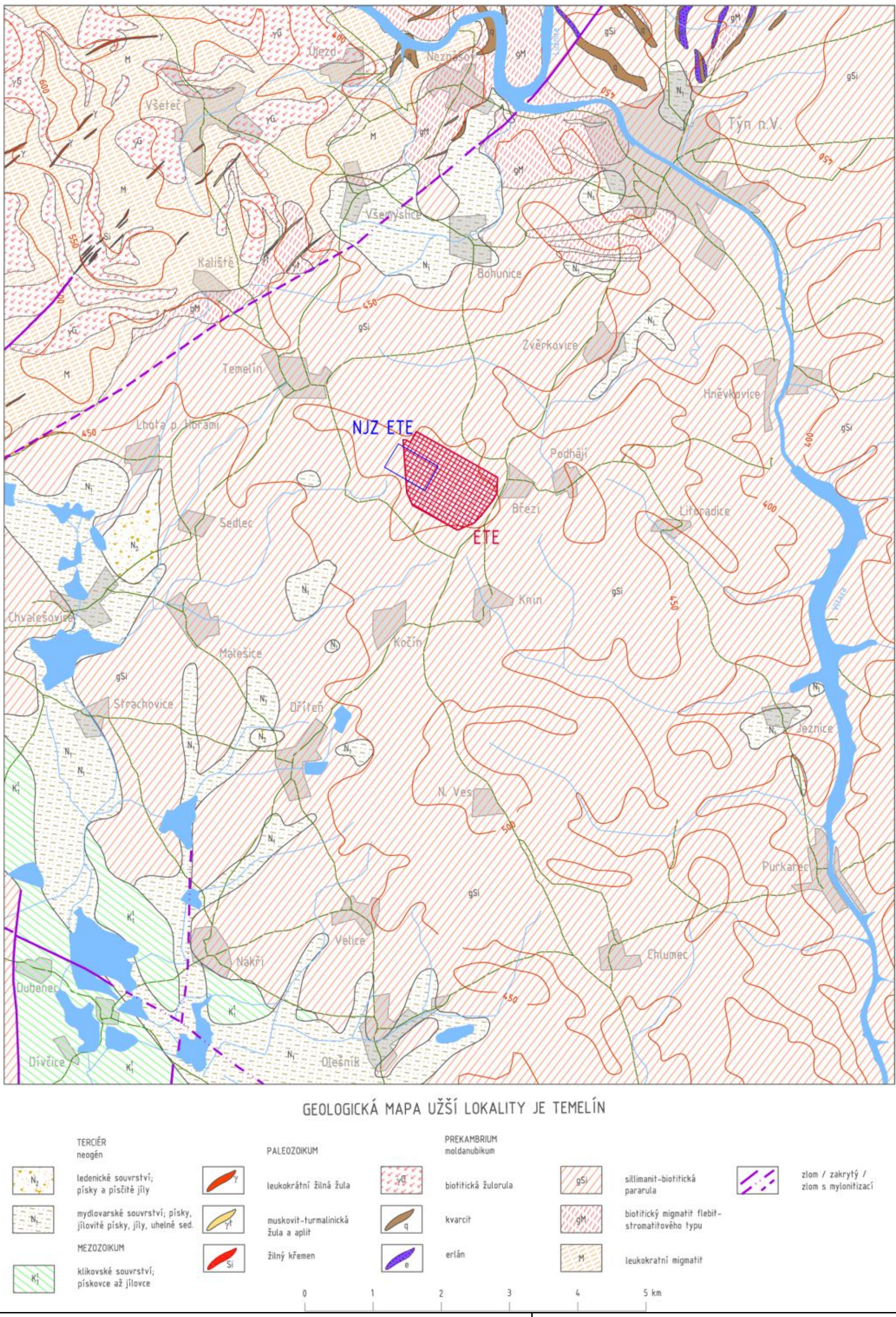
C.2.6.2.2. Geological situation at the construction site and in its nearest surroundings

From the geological structure aspect, the bedrock at the new nuclear installation construction site and in its near surroundings is primarily formed by Moldanubian metamorphites of a uniform series, consisting of a system of sillimanitic-biotitic paragneisses and migmatites. At some sites, this system is inter-veined or contains irregular bodies of granitoid rocks, mainly arranged in the NE-SW direction. Leukocratic veinous granites predominate, pegmatites and veinous quartz rocks are also abundant.

The “Vltava - Týn crystalline complex” mountain massif is a tectonically very little disturbed block formed by paragneisses isochemically migmatitised at various degrees, with a heterogeneity limited basically to the alternation of strip and massive positions. Rather extensive silicatisation is an important stabilising element.

The extensively preserved structure of the NE-SW direction, sloping to the NW, is a dominant structure-tectonic feature of the “Týn crystalline complex” massif (as well as of the new nuclear source construction site bedrock). Typical of this structure is multiple alternation of the slate positions of migmatitised paragneisses and migmatites, with numerous (usually interstratified) penetrations of granitoid rocks. The planar folded structure was disturbed by fault tectonics of local importance, with predominating tectonic dislocations mostly in the north-south direction.

Figure C.2.77: Geologic layout map of the NPP Temelín site



NJZ ETE	NNPP Temelín
ETE	Temelín PP
GEOLOGICKÁ MAPA UŽŠÍ LOKALITY JE TEMELÍN	GEOLOGICAL MAP OF TEMELÍN NPP IMMEDIATE LOCALITY
TERCIÉR neogén	TERTIARY, Neogene
ledenické souvrství; písky a písčité jíly	Ledenice Series; sands and sandy clays
mydlovarské souvrství; písky, jílovité písky, jíly, uhelné sed.	Mydlovary Series; sands, clayey sands, coal sediments
MEZOZOIKUM	MESOZOICUM

klikovské souvrství; pískovce až jílovce	Klikovské Series; sandstones to claystones
PALEOZOIKUM	PALEOZOIC
leukokrátní žilná žula	leucocratic, veiny granite
muskovit-turmalinická žula a aplit	muscovite-tourmaline granite and haplite
žilný křemen	veiny quartz
PREKAMBRIUM moldanubikum	PRE-CAMBRIAN Moldanubicum
biotitická žuloruda	Biotitic granite ore
Kvarcit	quartzite
Erlán	erlan
sillimanit-biotitická pararula	silimanite-biotitic paragneiss
biotitický migmatit flebit – stromatitového typu	biotitic migmatic phlebite of stromatolite type
leukokratní migmatit	leucocratic migmatite
zlom / zakrytý / zlom s mylonitizací	Fault / hidden / fault mylonisation

The disturbances appear as a system of directional, occasionally non-linked and uneven discontinuities, bound to the occurrence of rigid rock bodies of limited extent (granitoids in particular), on which balancing of tectonic strains took place, inducing mainly semi-plastic deformations of the lithological positions in the surrounding “softer” gneiss complex. The rocks in the zones, up to several metres wide, are highly to very highly fissured, weathered to highly weathered, with frequent secondary transformations, however, without any continuous and thick filling, with dislocation clay for instance. The disturbances, however, are not regional geologic lineaments disturbing the continuity of the Moldanubian block of the main construction site.

Nevertheless, the neotectonic lifting of the territory in the Pliocene and Old Pleistocene manifested itself in the rock massif mainly by the formation of fissures from the foliation planes, partial displacements along the foliation, especially at the sites of contact of the thinly banded and massive (strongly silicified) gneisses, and cataclasis of the rigid rock types mainly affecting silicified metamorphite types. This, however, mainly concerns lithological locations of small extent (only rarely several metres thick). Among additional manifestations of this activation are partial displacements within the gneiss massif with the occurrence of inclined grooving, polishing or disturbances with mylonite.

Sillimanitic-biotitic paragneiss and its equivalents migmatitised to various degrees constitute the major rock type at the main construction site. Their proportion at the construction site is 94%. Venous Variscian granitoids (granites - pegmatites) reach usually small thicknesses only at the construction site and are only locally present. They constitute about 6% of the bedrock.

The strongly weathered crystalline bedrock is covered by a thin Quaternary layer. This layer mainly consists of loam sediments, with a small fraction of clay loam or clay gravel on a basis of the covering layer complex.

Available information regarding the geological and geotechnological situation at the construction site for the new reactor units of NPP Temelín is based on several stages of drill-hole exploration, field tests and laboratory analyses of the rocks.

The foundations situation at the expected locations of the major buildings of the NNPP are characterised at the level of a detailed geological engineering survey of the construction site. It follows from the survey that the main buildings will be founded on rocks with a low degree of weathering, tectonically little disturbed and with a sufficient load-bearing capacity, the bedrock's modulus of deformation being higher than 100 MPa.

The coarse ground-shaping work performed prior to the construction of the existing Temelín 1 and 2 reactor units, making the ground flat and removing a layer of earth and weathered rocks about 5 to 10 m thick, should be taken into account in this context. The unit 1 and 2 buildings were founded to a depth of 7 to 8 m, which implies that the level of the foundation base was about 10 to 15 m below the initial ground level. The buildings of the new reactor units 3 and 4 will be founded likewise.

C.2.6.3. Hydrogeological situation

Ground waters in the NPP Temelín wider surroundings are bound to superincumbent formations, to weathered and disturbed crystalline rocks and their eluvia, and to the fissure system and tectonic faults of the rocks. Capacity is in the order of magnitude of tenths to hundredths of litres per second.

Two spatially unrelated ground water horizons exist at the Temelín construction site:

- a shallow circulation horizon, bound to Quaternary sediments and to the near-surface zone of eluvia, largely at the Quaternary-eluvium interface or on the basis of the eluvium, and
- a fissure water horizon, bound to the fissure system of the deeper bedrock.

The waters of the shallow waterlogged system are characterised by a slow circulation of the ground waters, which are made up by precipitation over the entire territory. In the natural state, the waters are drained through springs, wetland in ground depressions and hidden water seepage into local watercourses (beyond the plant area). The zone with a vivid circulation of such waters can be found to a depth of approximately 25 to 30 m under the ground. The shallow circulation horizon was affected significantly by the construction of NPP Temelín, and it is very likely that its regime within the plant area currently depends especially on the surface water draining system and on the conditions of circulation in the earth of backfills. Thus, the hydrogeological situation at the main construction site for the new nuclear reactors within NPP Temelín is rather complex.

The permeability (capacity of the hydrogeological collector for letting ground water through) of the superincumbent layers and eluvia of the paragneiss is low, markedly permeable granite eluvia or low-clay sands with a filtration coefficient $k \approx 10^{-7}$ to 10^{-6} $m.s^{-1}$ are only locally present. The transmissivity (capacity of the hydrogeological collector for enabling a certain ground water flow) of the fissure environment of the crystalline system to a depth of approximately 50 m is rather low as well (although normal in metamorphic massifs), $5.1.10^{-5}$ m^2s^{-1}. Ground water level is normally present at the interface between the Quaternary cover and the eluvium of the crystalline system or near the base of the eluvium. The current level is considerably affected by the previous coarse groundwork and excavation work.

From the chemical aspect, this is water with a low total mineralisation, neutral to weakly acid, with a predominant presence of Na - Ca - Mg - HCO_3 - SO_4 ions. From the point of view of ČSN EN 1997-1 (731000) - Eurocode 7: General basis for the geotechnical aspects of the design of buildings and civil engineering works, the water is very weakly aggressive to concrete civil engineering structures (i.e. they have a low content of aggressive CO_2).

The ground water regime of the deeper waterlogged system is characterised by stagnating or very slowly moving ground water of Holocene age, approximately 10,000 years, which has no direct contact with the ground and is not affected appreciably by atmospheric precipitation in normal conditions and at an unaffected hydraulic gradient. This horizon lies at a depth of 100 m and more under the ground.

C.2.6.4.Seismicity of the site

Generally, the predominant part of the territory of the Czech Republic, notably Central Bohemia, is characterised by a low seismic danger, described as score 5 on the MSK-64 scale. Due to the effect of east-Alpine earthquakes, seismic danger up to score 6 on the MSK-64 scale must be considered for the South-Bohemian region. The macroseismic fields of the earthquakes are frequently anomalously elongated to the north.

From among the east-Alpine earthquakes, the Temelín construction site is affected by tremors from the Molln-Scheibbs-Neulengbach source area, as well as by tremors generated at the Vienna thermal line - the Mur-Mürz-Leitha fault. Local tremors were experienced particularly at the periphery of the Bohemian Massif, e.g. in the Šumava-Grafenau-Thalberg, Kaplice and Linz-Pregarten source areas.

It follows from the assessment of the seismic endangerment of the Czech Republic that historical earthquakes in the above areas induced foundation soil acceleration at the construction site not exceeding 0.05 g (at a period of return of 1,000 years and a 90% probability that this won't be exceeded during a time period of 10^5 years).

Figure C.2.78: Map of seismic endangerment of the Czech Republic, in PGAH, for a period of return of 10,000 years and a 90% probability that this will not be exceeded during a time period of 10^5 years

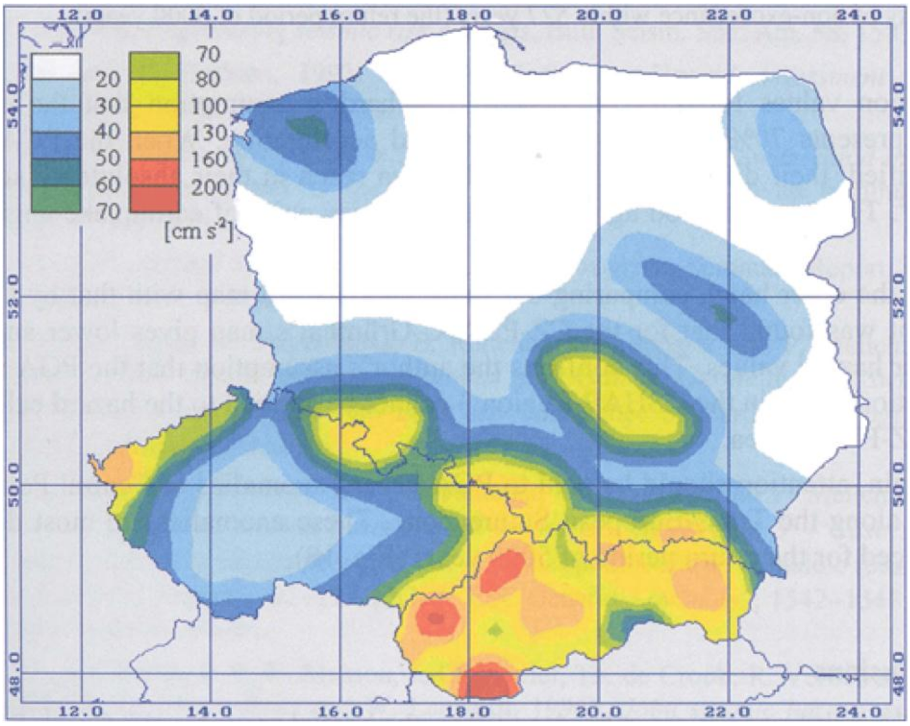
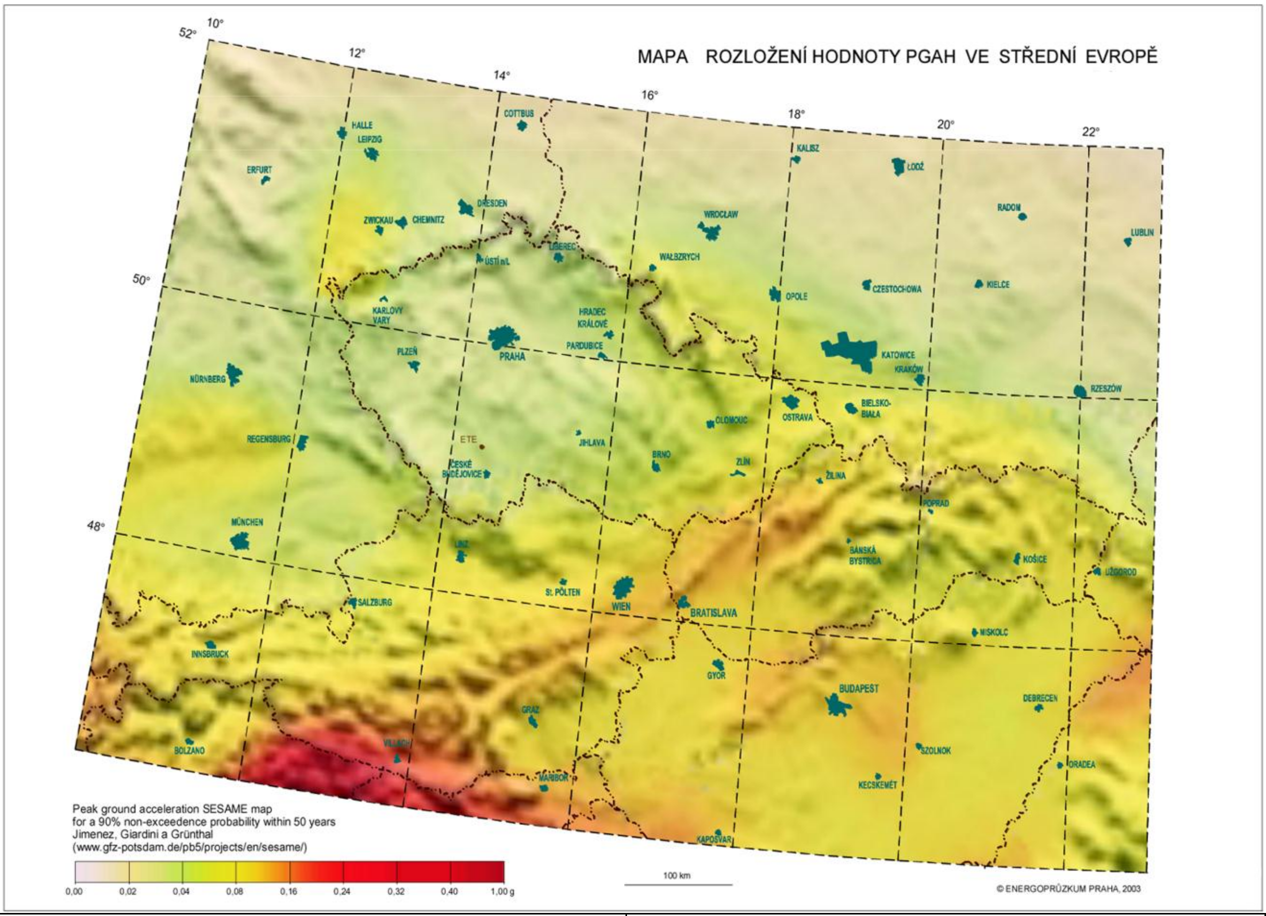


Figure C.2.79: Map of distribution of the PGAH values at a 90% probability that they will not be exceeded in 50 years (reproduced from the ESC SESAME (Seismotectonics and Seismic Hazard Assessment of the Mediterranean Basin, 1996-2000) project)



MAPA ROZLOŽENÍ HODNOTY PGAH VE STŘEDNÍ EVROPĚ	MAP OF DISTRIBUTION OF PGAH VALUES IN CENTRAL EUROPE

A local seismological network (SDR ETE – Temelín NPP detailed seismic zoning), built and operated based on IAEA recommendations, has been operated in the wider surroundings of the plant since 1991. Its task is to detect and locate tectonic microquakes from the NPP Temelín surroundings. Focus of the DSR ETE is on the recording of local microtremors with a magnitude from 1 to 3. Apart from tectonic earthquakes, the network of stations also records induced mining tremors and industrial explosions.

Topical information regarding manifestations of earthquakes in South Bohemia and their impacts on the Temelín site are published on the Seismological information display at www.ipe.muni.cz/seismologie_Temelín.

C.2.6.5.Raw material resources and other natural resources

No protected resource areas in the territory under study have been registered. No regions of slide or undermined areas are registered there. No sites of geological interest are present in the area involved in the construction project.

C.2.7. Fauna, flora and ecosystems

C.2.7.1. Biogeographical properties of the region

In the biogeographical categorisation of the Czech Republic (Culek 1996) the area of interest falls in Bioregion 1.21 - Bechyně. Vegetation stage 3 (oak-beech stage) and 4 (beech stage) predominate in the region.

In the zoogeographical categorisation (Mařan in Buchar 1983) the region lies in the Czech segment of the province of broad-leaved forests.

In the regional phytogeographical categorisation (Skalický in Hejný et Slavík 1988) the area lays in the phytogeographical regions of the Mesophyticum, within the Bohemian-Moravian Mesophyticum, in the district of South-Bohemian Hilly Land, Písek - Hluboká crest subdistrict.

C.2.7.2. Fauna and flora

For the purpose of documentation development, biological assessment has been performed pursuant to Section 67 of Act no. 114/1992 on the protection of nature and landscape (as amended) (Biological assessment in the sense of Section 67 pursuant to Section 45 (i) of Act no. 114/92 on the protection of nature and landscape (as amended) for the project of a new nuclear installation at the Temelín site, including power output to the Kočín switchyard. RNDr. Vlastimil Kostkan, PhD, November 2009). It was the aim of the biological assessment to evaluate the impacts of the planned construction of the new nuclear installation at the existing NPP Temelín site, including the required infrastructure. The assessment also covers the simultaneous operation of the new and old reactor units. The biological assessment was primarily focused on specially protected plant and animal species, on the preservation of populations of all plant and animal species directly or indirectly affected by the construction and/or operation of the new nuclear installation and on the preservation of the functions of the ecosystems in the plant surroundings.

The biological assessment has been developed based on a series of field surveys specifically performed in 2009 for this project (Rozínek et Francek, Biologické průzkumy okolí JE Temelín a trasy vyvedení výkonu NJZ a vodovodního řádu. [Biological surveys of the NPP Temelín surroundings and of the route for power output from the NNPP and the water mains.] Díl 1 Botanický a Entomologický průzkum. [Pt. 1. Botanical and entomological survey.] Díl 2 Ichtyologický, Malakologický, Ornitologický a Mammaliologický průzkum. [Pt. 2. Ichthyological, malacological, ornithological and mammaliological survey.] Díl 3 Herpetologický průzkum. [Pt. 3. Herpetological survey.] NaturaServis s.r.o., October 2009). Furthermore, information regarding the biota in the region from the previous years (Bejček et al 2006, 2007, 2008) and reports on environmental monitoring of the NPP Temelín surroundings were also used for comparison.

The area of interest was divided into 4 basic sub-areas for all survey types:

- Sub-area no. 1: Internal part of NPP Temelín (inside the fenced area)
- Sub-area no. 2: NPP Temelín surroundings
- Sub-area no. 3: Water mains
- Sub-area no. 4: Power output

For the various groups of organisms, the sub-areas were divided further into partial sites or points where samples were taken. The areas, sub-areas, etc., are shown in the orthophotomaps included in the various sections below.

Sub-area no. 2 in the planned area of the cooling towers for the initially considered units 3 and 4 used to be cultivated for farming prior to 1985. After 1985, this sub-area was prepared by earthwork for the construction of the cooling towers for the initially planned units 3 and 4, the preparation, however, was never completed.. Since units 3 and 4 were not constructed immediately following units 1 and 2, the area has remained practically without human intervention since the late 1980s, hence, for approximately 20 years. Thus the site is not a natural site. It is a site formed by man in relation to the construction of the first 2 Temelín reactor units. Today the site is considered biologically valuable.

The present document includes an extract from the biological assessment only. The overview of the biological species identified is limited to specially protected taxons and species deserving attention. A detailed description of the region and the sites examined, an overview of all plant and animal species identified, the methods, published information, results of studies and other information are included in the text of, and annexes to, the biological assessment.

C.2.7.2.1. Flora

This section, dealing with plants, has been developed based on detailed analyses of the region performed by RNDr. Jiří Sádlo, CSc., within the study by Rozínek et Francek (2009) and by comparison with older data published by Bejček et al (2007, 2008).

The two studies were able to identify in a very detailed way the species composition of the vegetation in the area planned for the construction of the new nuclear installation within NPP Temelín and in the surroundings, including areas that may potentially be impacted by the completion and reconstruction of the infrastructure needed for the new installation.

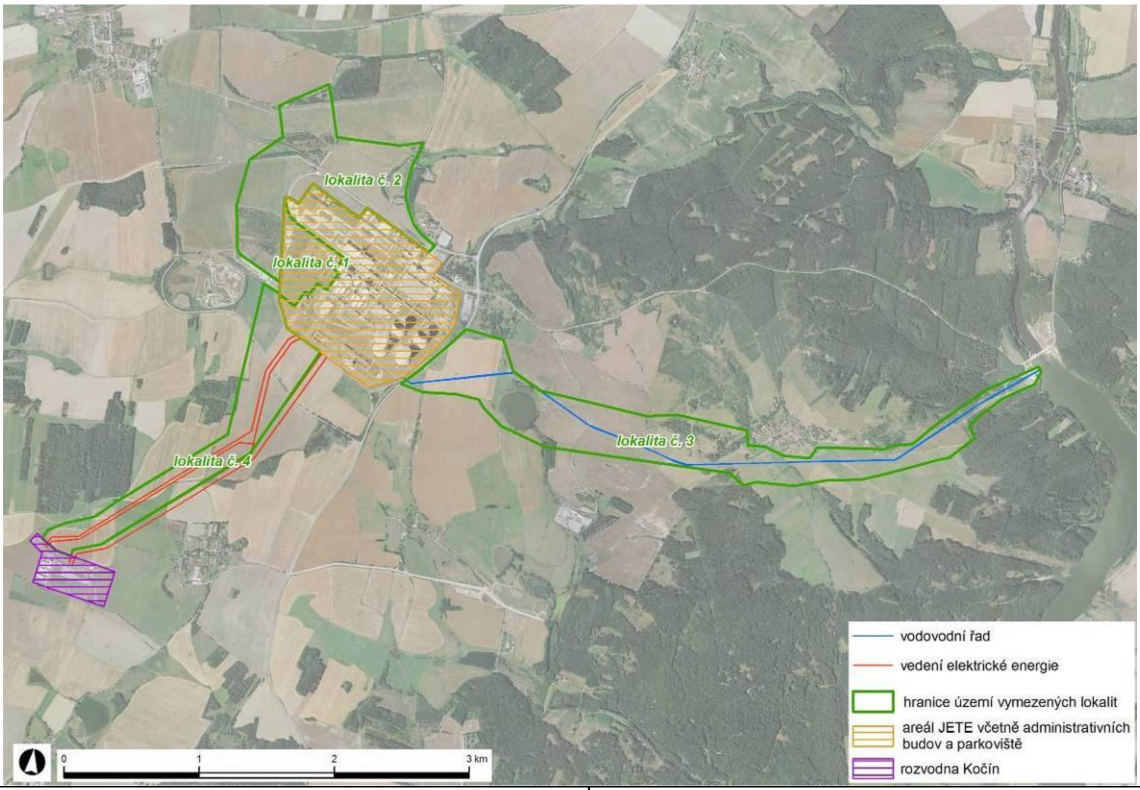
Owing to the detailed and independent studies, it is highly unlikely that any important plant communities or their fragments or any populations of specially protected or endangered plant species remained overlooked.

The floristic survey was performed during June and July 2009, i.e. during a period when the majority of local species is in their optimum phenological development. The plant names follow the standard field guide by Kubát (2002). From among the taxons identified, attention is paid particularly to:

- specially protected plant species and species of other value from the environmental protection aspect,
- Neophytes, with focus on potentially highly invasive species.

The surveys by Rozínek et al. (2009) covered 4 areas, divided with respect to the planned building projects and by the nature of the territory. The areas are shown in the map below.

Figure C.2.80: Identification of the basic areas of the botanic field survey



Vodovodní řad	Water mains
Vedení elektrické energie	Power lines
Hranice území vymezených lokalit	Boundary of delimited localities territory
Areál JETE včetně administrativních budov a parkoviště	Temelín NPP complex including administrative buildings and parking lot

Rozvodna Kočín	Kočín switchyard

Overview of specially protected species and species deserving attention

A total of 814 plant species were identified by the floristic survey.

No specially protected plant species pursuant to Act no. 114/1992 on the protection of nature and landscape (as amended) were identified within the entire territory.

From among the species included in the Red List of the Czech Republic, only “quite rare species requiring attention” (C4) and “endangered species” (C3), i.e. species of lower categories of rareness, were identified. An overview of those species in given in the table below.

Table C.2.42: List of identified plant species included in the Red List of the Czech Republic

Latin name	English name	Red List	Site
Centaurium erythraea	Common centaury	C4	1, 2, 3, 4
Epilobium palustre	Marsh willowherb	C4	2, 4
Filago arvensis	Field cottonrose	C3	1
Utricularia australis	Yellow bladderwort	C4	2
Thalictrum lucidum	Shining meadow rue	C3	3
Veronica scutellata	Marsh speedwell	C4	2, 3
Vulpia myuros	Rat’s tail fescue	C3	1
Odontites versus	Red bartsia	C2	2

The species in the Red List of the Czech Republic are not covered by protection stipulated by law unless the species are simultaneously categorised as specially protected plant species under Act no. 114/1992 Coll. on the protection of nature and landscape. No such species have been identified within the examined territory.

None of the specially protected plant species were found by the team of Bejček et al (2007) either. From among the above species included in the Red List, only red bartsia was found by the team on sub-area no. 2.

C.2.7.2.2. Fauna

C.2.7.2.2.1.Hydrobiology

The current status of aquatic invertebrates could not be exactly assessed because no samples from sites lying downstream of the mouth of the NPP Temelín wastewater duct are available. At those sites, as well as at sites lying upstream, the Orlík and Kořensko reservoirs interfere, precluding any standard sampling of the zoobenthos by means of a benthic network in the transverse river profile.

Therefore, data obtained by the “Povodí Vltavy” water management company for the Vltava basin from the Hluboká nad Vltavou profile (zoobenthos sampling in 2007) and Týn nad Vltavou profile (sampling in 2006) were used. Thus the 2 profiles represent the situation in the Vltava River upstream of the NPP wastewater draining duct.

Overview of specially protected species and species deserving attention

No specially protected species pursuant to Section 48 of Act no. 114/92 on the protection of nature and landscape (as amended) were identified among the invertebrates in the samples taken from the 2 sites on the Vltava River. None of the species is included in the Red Lists or protected under international conventions either.

The zoobenthos is represented rather by thermophilic species of the middle and lower courses, which are normally adapted to the day/night water temperature variations as well as to the elevated concentrations of organic substances and marked variations of dissolved oxygen. The relative abundance of larvae of non-biting midges and of representatives of oligochaeta worms documents the proportion of taxons preferring life in muddy sediments. When comparing the two sampling sites, a decrease in the number of taxons is apparent at the Týn nad Vltavou profile, as well as the vanishing of taxons possessing some affinity for colder, well flowing and oxygen-rich waters of the upper courses of rivers, such as riffle beetles *Limnius volckmari* and the small silver sedge, *Lepidostoma hirtum*. This change is presumably due to the change in the hydrological conditions at Týn nad Vltavou and/or the starting water flow hold-up caused by the Kořensko reservoir.

The following factors should be considered in the context of potential impacts of the NPP Temelín operation on aquatic invertebrates in the Vltava River:

- water level decrease due to water withdrawal for the plant and its return to the river,
- water temperature variations due to the discharge of the warmed waste water,
- water quality change in the river due to the discharge of wastewaters from NPP Temelín (organics, nutrients, radionuclides).

Assessment of the past impacts of NPP Temelín operation

Analysis of NPP Temelín operation since 2000 till the present with respect to the withdrawal of untreated water from the Hněvkovice reservoir and draining of the wastewater, warmed and concentrated by evaporation, into the Vltava River at Kořensko revealed the following impacts of the operation of the 2 reactor units during the period from the 4th quarter of 2003 to the 3rd quarter of 2009.

Water flow

NPP Temelín affects the Vltava River primarily by withdrawing water for cooling and other technological uses and by discharging waste water, which differs from the withdrawn water in amount, temperature and chemical composition. Water for NPP Temelín has been taken from the Hněvkovice reservoir since 2006 at mean monthly rates of 0.6-1.5 $m^3.s^{-1}$. The mean annual wastewater discharge flow rate decreased slowly to reach 0.19 $m^3.s^{-1}$ in 2008. The difference between the withdrawn and discharged volumes (volume reduction to 1/4-1/5) is primarily due to water evaporation in the cooling towers and other plant facilities. As a consequence of this water loss by evaporation, the mean annual flow rates in the Vltava River at Kořensko during the operation of the 2 reactor units had been 1.0% to 2.2% lower since 2004 (Hejzlar et al. 2009). The flow rates at Kořensko during the 2000-2008 period were between 12.0 $m^3.s^{-1}$ (July 2003) and 377 $m^3.s^{-1}$ (August 2002), with a mean flow rate of 57.4 $m^3.s^{-1}$. The wastewater was diluted appreciably by the river water in dependence on the flow rate of water in the river. The degree of dilution was lowest (1:30) in the summer season with reduced flow rates, and highest in the spring season, with the highest flow rates due to thawing and outflow of snow and ice accumulated during winter.

Table C.2.43: Average annual flow rates in the Vltava River at Kořensko: untreated water withdrawn from the river and wastewater discharges from NPP Temelín and other derived indicators illustrating the effect of the plant operation on the flow conditions in the Vltava (modified from Hejzlar et al., 2009)

Year	Vltava - Kořensko [$m^3 s^{-1}$]	Withdrawn by the plant [$m^3 s^{-1}$]	Discharged by the plant [$m^3 s^{-1}$]	Water loss [$m^3 s^{-1}$]	Flow rate reduction at Kořensko [%]
2000	41	0.07	0.05	0.02	0.06
2001	44	0.23	0.13	0.10	0.22
2002	117	0.61	0.19	0.42	0.36
2003	41	1.06	0.29	0.78	1.85
2004	53	1.08	0.26	0.82	1.51
2005	60	1.04	0.24	0.80	1.31
2006	84	1.14	0.25	0.88	1.03
2007	41	1.14	0.24	0.90	2.14
2008	39	1.07	0.19	0.88	2.18
4th q. 2003 - 3rd q. 2009	52	1.08	0.25	0.89	1.68

Water temperature

The temperatures of the wastewater discharged by NPP Temelín exhibited yearly cycles, with the lowest temperatures in winter (typically 13°C to 18°C) and the highest temperatures in summer (typically 21°C to 27°C). The summer temperatures were roughly equal to those in the river. Balance calculation has shown that the warming of water in the Vltava River due to NPP Temelín wastewater discharge never exceeded the maximum of 0.4°C reached 13 December 2003. In the monthly averages the temperature of the Vltava water increased by 0.1 to 0.15°C in winter and by less than 0.05°C in summer. This increase is insignificant in comparison with the yearly temperature variability, which is typically from 3°C to 8°C at Kořensko.

Chemical composition of the water

NPP Temelín affects the water composition appreciably due to water loss by evaporation, which reaches 75-80% of the amount withdrawn from the river. In other words, the plant affects the water composition due to the concentration change even in the absence of any other intervention into the chemical composition. Other processes affecting the absolute amounts of the various substances in the discharged water against the withdrawn water also occur in the plant, e.g. raw water treatment and wastewater treatment. Annual changes in the amounts of organic substances and nutrients caused by the plant indicate that the amounts of insolubles in the untreated water withdrawn were reduced by the plant (since 2004 when unit 2 was made operational, the amounts of insolubles removed from the water were 174 tonnes annually in the average, i.e. over 50% of the incoming amount). Appreciable decrease is also observed in the organic pollution indicator BOD_5, as well as in the COD_{Mn} level and, to a lesser extent, in the COD_{Cr} level and some other pollution indicators.

The concentration levels of major non-radioactive substances in the river during the past years are summarised in the table below. The table demonstrates that the yearly averages never exceed the relevant water pollution limits. Closest to the mean annual pollution limit is the COD_{Cr} indicator (limit = 25 $mg.l^{-1}$). The mean COD_{Cr} level is 24.8 $mg.l^{-1}$ in the untreated water and 24.94 $mg.l^{-1}$ downstream of the point of discharge into the Vltava. Current NPP Temelín operation (water withdrawal from the Vltava at Hněvkovice and wastewater discharge at Kořensko) brings about a certain, not very significant change in the river water quality. With respect to the BOD_5, $N\text{-}NH4^+$ and anionic surfactant levels, the quality of the wastewater discharged from the plant is better than that of the river water at Kořensko, which implies that the discharge brings about a minor water quality improvement downstream of the wastewater discharge point (roughly by 0.1%, 0.2% and 0.01%, respectively). As regards the remaining indicators, on the contrary, the discharge brings about a slight water quality deterioration. The relative increments (quality deterioration) are as follows: COD_{Mn} 0.5%; COD_{Cr} 0.6%; SO_4^{2-} 1.9%; $N\text{-}NO_3^-$ 2.1%; N_{inorg} 2.0%; $P\text{-}PO_4^{3-}$ 2.5%; P_{tot} 0.8%; insolubles 0.1%; non-polar extractable substances 0.1%; and soluble inorganic substances 1.7%.

Table C.2.44: Effect of NPP Temelín operation (2x1000 MW_e) on the Vltava River water quality, mean values 2004-2008

Quality indicator	Kořensko, 2004-2008 mean	NPP Temelín wastewaters mean 2004-2008	Kořensko, downstream of NPP Temelín	Increment by NPP Temelín	Increment by NPP Temelín
	$[mg.l^{-1}]$				[%]
BOD_5	3.47	2.53	3.46	-0.004	-0.1
COD_{Mn}	8.16	17.36	8.20	0.044	0.5
COD_{Cr}	24.80	54.53	24.94	0.14	0.6
SO_4^{2-}	25.10	125.02	25.57	0.47	1.9
$N\text{-}NH_4^+$	0.15	0.09	0.15	-0.0003	-0.2
$N\text{-}NO_2^-$	-	0.05	-	-	-
$N\text{-}NO_3^-$	1.60	8.88	1.63	0.03	2.1
N_{inorg} *)	1.75	9.02	1.78	0.03	2.0
$P\text{-}PO_4^{3-}$	0.03	0.19	0.03	0.0007	2.5
P_{tot}	0.12	0.32	0.12	0.001	0.8
SS	13.35	17.00	13.37	0.02	0.1
NES	0.05	0.07	0.05	0.00007	0.1
Anionic surfactants	0.05	0.05	0.05	0	-0.01
DIS	81.35	370.67	82.72	1.37	1.7

*) sum of $N\text{-}NH_4^+$ plus $N\text{-}NO_3^-$

Although the absolute amounts of some substances were reduced by the NPP Temelín operation, their concentration in the Vltava increased as a consequence of evaporation. However, owing to the dilution by the river water, the concentration increase did not exceed tenths to units percent. The concentration increase was higher during dry seasons: for instance, in July 2007 the concentrations of soluble substances, N_{tot}, and P_{tot} in the Vltava were increased by NPP Temelín operation by 9.4%, 11.2%, and 7.1%, respectively.

Radiological water composition

Radioactive substances constitute a specific group produced by NPP Temelín operation and affecting the Vltava River water quality. The major man-made radionuclides discharged from the plant include tritium and other activation and fission products (AaFPs), represented particularly by caesium 137, caesium 134 and strontium 90.

However, NPP Temelín is not the sole source of man-made radionuclides in the Vltava. Residual contamination from atmospheric nuclear weapon tests and from the Chernobyl accident also contributes. Available data demonstrate that the Vltava upstream of the NPP Temelín wastewater discharge point has been experiencing a slow linear decrease of the specific activity of radionuclides during the past decades. Tritium decreased from approximately 1.6 $Bq.l^{-1}$ to approximately 1.0 $Bq.l^{-1}$ during the 1999-2009 period. Availability of radiation background data allows us to discern even very small NPP Temelín impacts, including the NNPP. As a conservative estimate, the tritium background in the Vltava downstream of the wastewater discharge point will be assumed to be 0.8 $Bq.l^{-1}$ as a basis for forecasting the impacts of NPP Temelín and the NNPP.

The specific activities of caesium 137 (determined as specified by ČSN ISO 10703) in all substances, i.e. in the soluble and insoluble forms in total, also exhibited a decreasing trend during the 1990-2008 period. The mean specific activity of caesium 137 at the site of water withdrawal for the plant was at the level of 0.001 $Bq.l^{-1}$ in 2008. For forecasting the effect of the NNPP, the specific activity of caesium 137 is assumed conservatively to be 0.0005 $Bq.l^{-1}$. Similar attention has been paid to strontium 90. A decreasing specific activity trend was observed for this radionuclide as well. Its mean level was below the detection limit of 0.006 $Bq.l^{-1}$ in 2008. Neither caesium 134 nor other AaFPs from the Chernobyl accident have been detected.

The specific activities of the AaFPs are so low that they cannot be discerned when determining total specific beta activity as per ČSN 75 7612. As to tritium, this procedure (ČSN ISO 9698) does not detect radionuclides with beta energies which are as low as the energy emitted by tritium. The AaFP content is so low that the specific procedures described above must be resorted to.

The indicator represented by the total specific beta activity mainly describes the levels of potassium 40 contained in natural potassium. For a potassium concentration of 5 $mg.l^{-1}$ the total specific beta activity is 0.137 $Bq.l^{-1}$ (1 mg of potassium contains 0.0274 Bq of beta activity).

Knowing the residual contamination from atmospheric nuclear weapon tests and from the Chernobyl accident, attention was also paid to the amounts of AaFPs (except tritium) in river bottom sediments and in the water plant and fish biomass. As in the water samples, increased caesium 137, caesium 134 and strontium 90 were observed in the material. A decrease in the man-made radionuclide contents was also observed in the above components of the hydrosphere. Caesium 134 has been below the limit of detection since 1998. No other man-made radionuclides were detected.

Specific caesium 137 activities in river bottom sediment samples taken from the tributaries of the Orlík reservoir, i.e. the Lužnice, Otava and Vltava rivers, lay within the region of 19.1-84.7 $Bq.kg^{-1}$. Strontium 90 in the samples was below the limit of detection in 2008. This means less than 2.2 $Bq.kg^{-1}$ in the Vltava at Týn nad Vltavou, less than 1.5 $Bq.kg^{-1}$ in the Lužnice at Koloděje, and less than 2.5 $Bq.kg^{-1}$ in the Otava at Písek. The mean specific activity of strontium 90 in the sediments was lower than 1/22 of the specific activity of caesium 137 in the samples.

The specific activities of fish samples taken from the tributaries of the Orlík and Býšov reservoirs, from the Vltava at Hněvkovice upstream of the dam and from the Otava at Topělec lay within the region of 0.2-0.9 Bq per kg fresh weight. The highest levels were found in samples from the last-mentioned sampling site (Topělec). Caesium 134, with a shorter half-life, was below the limit of detection. Strontium 90 was also below the limit of detection (0.6 Bq per kg fresh weight) in 2008.

Reed was selected as a representative of the hydrobionts. Specific activities of caesium 137 and strontium 90 in reed from the Vltava at Hněvkovice downstream of the dam were 0.9 $Bq.kg^{-1}$ and less than 2.3 $Bq.kg^{-1}$ (dry weight), respectively, in 2008.

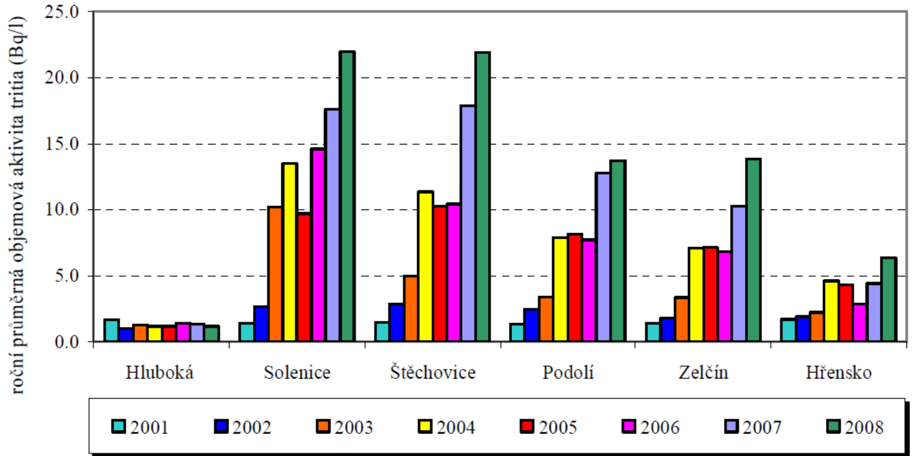
A slow increase in the balance of discharged radioactive substances was observed during the trial operation and subsequent routine operation of the 2 NPP Temelín reactor units. This is a phenomenon that is generally observed at any nuclear installation. The results of prediction of the specific activities of tritium and other AaFPs are given in the table below. The mean increments of tritium and the AaFPs (caesium 137) at the point of discharge of the wastewater into the Vltava are 41.6 $Bq.l^{-1}$ and 0.006 $Bq.l^{-1}$, respectively. The calculated data demonstrate that the tritium background (level in the Vltava at the reference site of Hluboká nad Vltavou) constitutes a negligible fraction of the increment caused by NPP Temelín operation. The situation is different with the remaining AaFPs, where residual caesium 137 from atmospheric nuclear weapon tests and the Chernobyl accident exceeds all AaFPs from the plant operation.

Table C.2.45: Effect of NPP Temelín operation (2x1000 MWe) on the radioactive content of the Vltava River, considering discharges at the limiting level laid down by the South-Bohemian Regional Authority, and the average quantities of discharged wastewater, 2004-2008

Quality indicator	Kořensko $_{c2,i}$ 2004-2008	NPP Temelín discharges mean 2004-2008	Kořensko, downstream of NPP Temelín	Increment by NPP Temelín, $\Delta_{c,i}$	Derived mean standard
	[Bq.l^{-1}]				
Tritium	1	8,794	42.6	41.6	700
Other AaFPs (caesium 137)	0.001	0.133	0.0016	0.0006	0.1

The predicted specific activities of tritium arising from NPP Temelín are also consistent with the results of measurements along the Vltava and in the Labe at Hřensko, 2001-2008, as demonstrated by the graph below. The Hluboká nad Vltavou site is a reference point for tritium in the Vltava unaffected by NPP Temelín operation. At the remaining monitoring sites, the mean annual specific activities are seen to have increased as the plant was gradually put into operation. The highest mean annual specific activities of tritium were observed in 2008, when the largest tritium activity, 54.3 TBq.yr^{-1}, was discharged. The highest mean specific activity in the Vltava at Solenice in 2008 was 22 Bq.l^{-1}.

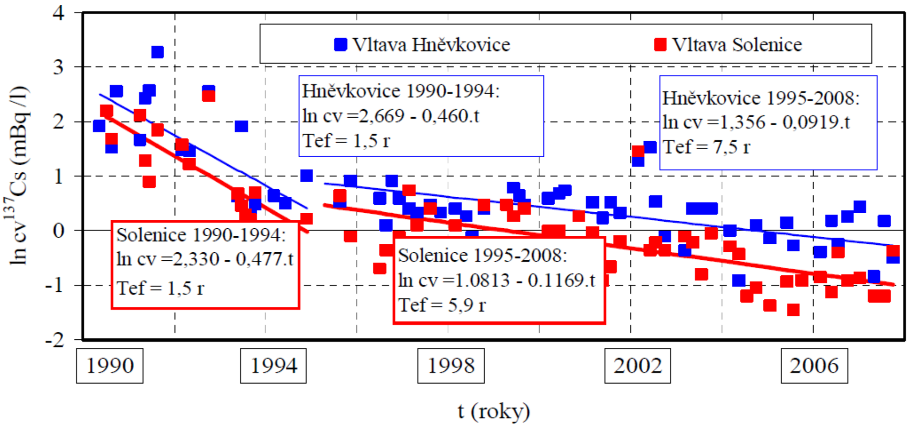
Figure C.2.81: Development of specific activity of tritium along the Vltava River and in the Labe at Hřensko, 2001-2008 (from Hanslík et al. 2009)



Roční průměrná objemová aktivita tritia	Average annual volumetric activity of tritium

The development of the remaining AaFPs during the 1990-2008 period is demonstrated on caesium 137 in the graph below.

Figure C.2.82: Development of specific activity of cesium 137 in the Vltava at Hněvkovice and at Solenice, 1990-2008 (from Hanslík et al. 2009)



The models demonstrate that the specific activity of caesium 137 in the Vltava at Solenice and downstream of the Orlík reservoir, or downstream of the point where NPP Temelín wastewater is discharged, has been decreasing monotonically, also during the period of NPP Temelín operation. A comparison with the trend at Hněvkovice upstream of the wastewater discharging point shows that caesium 137 has been decreasing between the 2 points due to sedimentation of the non-dissolved species and sorption of caesium 137 on non-dissolved matter, river bottom sediments and aquatic plant and animal biomass. Caesium 137 from the current NPP Temelín operation is thus completely obscured by its background of anthropogenic origin.

Conclusion

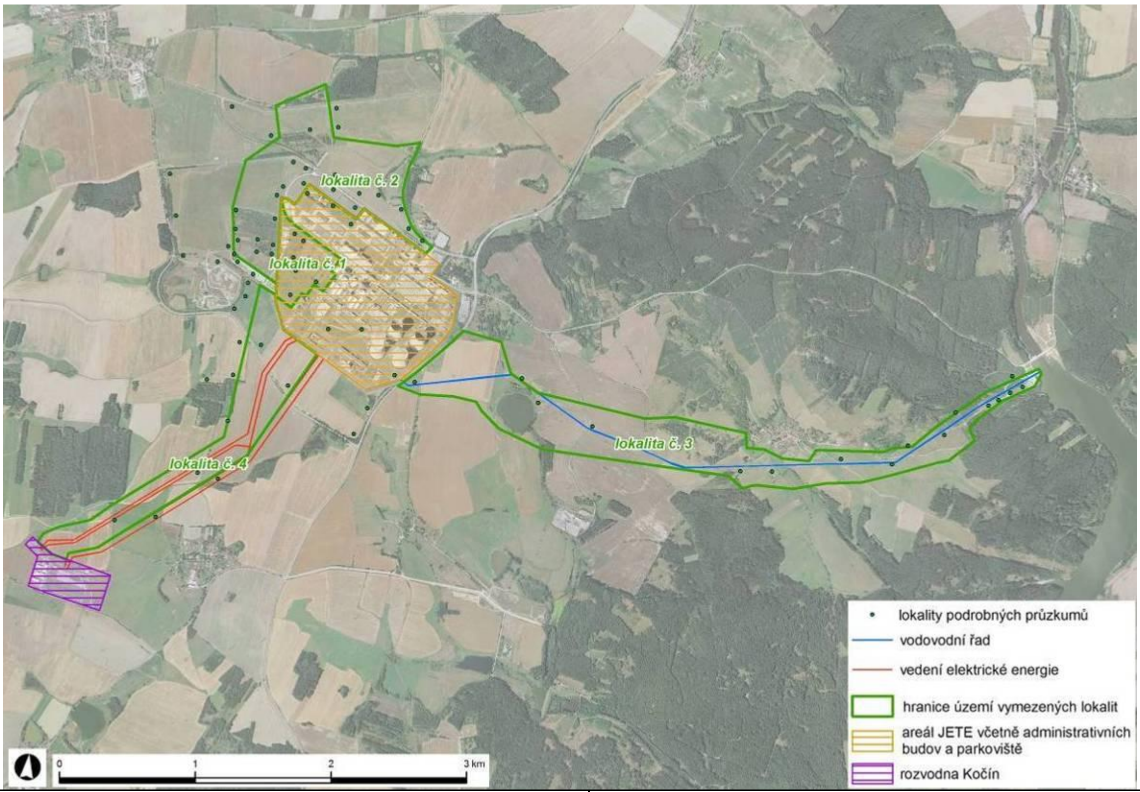
The conclusions of existing studies and knowledge extracted from available literature warrant the assumption that the impacts of NPP Temelín operation on aquatic invertebrates have been absolutely insignificant. This conclusion applies, in particular, to any changes in the flow rate and water temperature at the site of NPP Temelín wastewater discharge into the river.

As for the impact of radioactive substances, available data indicate that the specific activities of the radionuclides of interest in water have been exhibiting a constant decrease. Contamination was only observed in sediments, aquatic plants and fish. At any rate, radiocaesium (the most significant radionuclide in the Vltava) in fish samples attained levels which were considerably lower than the EU recommended intervention level for radiocaesium in foods (approximately 1 kBq per kg fresh weight, Smith et al. 2001).

C.2.7.2.2.2. Entomology

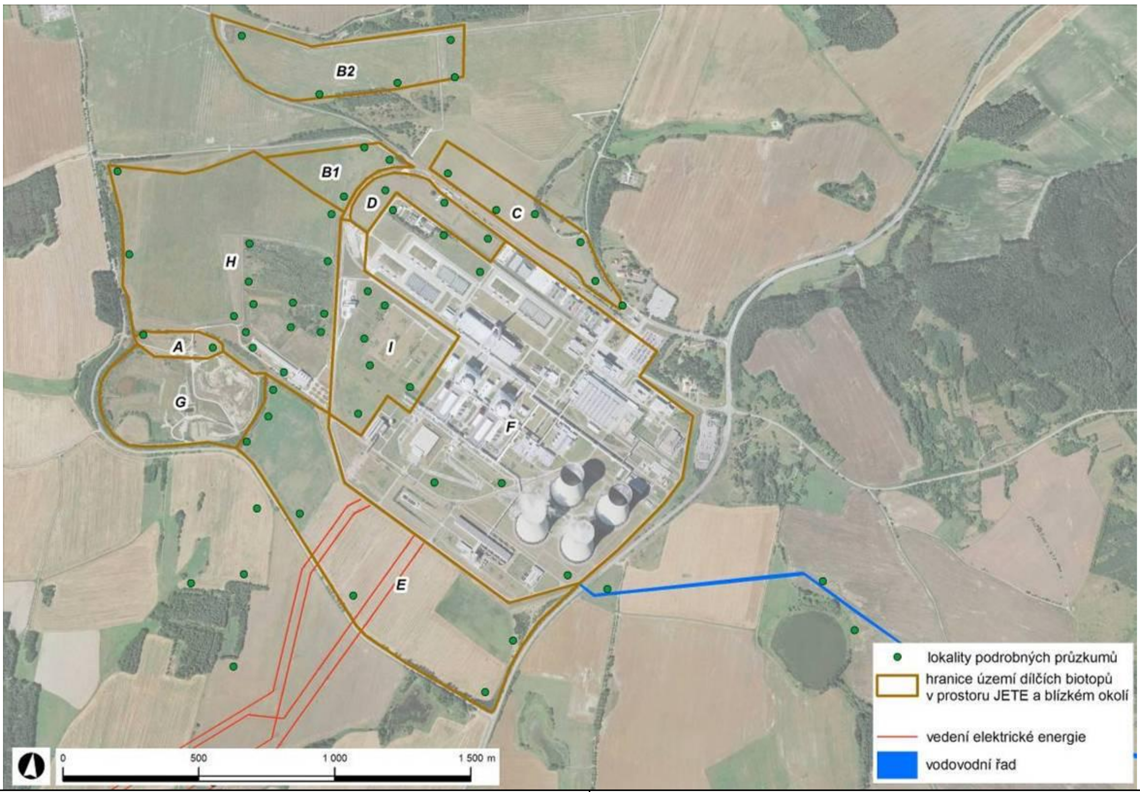
For the needs of their entomological survey, Rozínek et at (2009) divided the territory into several regions. With a view to a simplification of the interpretation and comparison with preceding surveys (Bejček et al 2007a), some partial survey areas were combined into sites identical with those used for the other scientific surveys. In view of the specificity of the NPP Temelín area itself and its immediate surroundings, which will be most impacted by the construction of the NNPP, the area was divided in more detail into sites for detailed entomological examination. The extent of the surveys will be clear from the 2 maps below.

Figure C.2.83: Layout of areas that were subject to entomological survey



Lokality podrobných průzkumů	Detailed survey localities
Vodovodní řad	Water mains
Hranice území vymezených lokalit	Boundary of delimited localities territory
Areál JETE včetně administrativních budov a parkoviště	TNPP complex including administrative buildings and parking lot
Rozvodna Kočín	Kočín switchyard

Figure C.2.84: Area of NPP Temelín and of the NNPP, divided into sub-areas for a detailed entomological survey



Lokality podrobných průzkumů	Detailed survey localities
Hranice území dílčích izotopů v prostoru JETE a blízkém okolí	Boundary of partial isotopes territory within the TNPP complex and immediate surroundings
Vedení elektrické energie	Power lines
Vodovodní řad	Water mains

Overview of specially protected species

The presence of the following specially protected insect species categorised as endangered species pursuant to the Ministry of Environment Decree no. 395/1992 was found. The name of the species is completed with the site and nature of occurrence of the species and a note regarding the abundance observed.

Table C.2.46: List of identified specially protected species

	Latin name	English name	Decree no. 395/1992	Site
Butterflies	*Apatura ilia*	Lesser Purple Emperor	E	(Bejček 2007a only) site 2
	Papilio machaon	Old World Swallowtail	E	Sites 1, 2
	Initially a steppe and forest-steppe species, currently living at many types of habitat, including gardens, fallows and ruderals. Not a very significant occurrence from the environmental protection aspect. At the site examined, this species was observed particularly on deponies and neighbouring ruderalised areas where plants which are nutrients to this species (Apiaceae) are also present.			
Bumblebees	*Bombus lapidarius*	Red Tailed Bumblebee	E	Sites 1, 2, 3
	Bombus ruderalis	(Bombus ruderalis)	E	Sites 1, 2, 3
	Bombus terrestris	Buff-tailed Bumblebee	E	Sites 1, 2, 3, 4
	In addition, the following species were detected by Bejček et al. in 2007:			
	Bombus bohemicus	Gipsy Cuckoo-bee	E	Site 2
	Bombus campestris	Field Cuckoo-bee	E	Site 2
	Bombus rupestris	Hill Cuckoo-bee	E	Sites 2, 3
	Bombus confusus	(Bombus confusus)	E	Site 2
	Bombus humilis	Carder Bumblebee	E	Site 2
	Bombus lucorum	White-tailed Bumblebee	E	Sites 2, 3
	All of them are rather abundant bumblebee species with a broad ecological valence. Especially the species *Bombus terrestris* and *Bombus lapidarius* occur in the whole territory, including agrocoenoses, where they find sufficient amounts of food on suitable crops.			
Ants	*Formica rufibarbis*	Red Barbed Ant	E	Sites 1, 2, 3
	Formica fusca		E	Sites 1, 2, 3, 4
	Once again, quite common species of “non-forest” ants without special demands on the habitat, classed as specially protected species apparently rather due to a difficult determination of ants. The species were observed on the majority of selected areas, particularly at ruderal habitats and other sites without intensive management.			
Carabidae	*Carabus scheidleri scheidleri*	(Carabus scheidleri)	E	Sites 1, 2, 3, 4
	This is an abundant carabus species in South Bohemia. It prefers meadows and other open sites, although it also occurs on field cultures if any refugia (bosks, balks, outcrops or other natural shelters) are available there. One specimen was found in the plant area (near the turbine halls), and a few specimens were found in the area intended for the construction of the new facilities, on field cultures along the power output route as well as on the water supply line route. This is a species which is apparently abundant over the area of the plant surroundings.			
	Cicindela campestris Linnaeus, 1758	Green tiger beetle	E	Sites 1, 2, 3
	A relatively abundant tiger beetle species with a broad ecological valence, which needs bare sand or sand-clay surfaces for its life. It also occupies secondary sites.			
	Oxythyrea funesta (Poda, 1761)	Spotty Rose Beetle	E	Sites 1, 2, 3, 4
	Formerly a rather rare steppe species of the Oxythyera, abnormally expanded over warm parts or the territory recently, with its centre of occurrence on balks and forest edges. In can be found in diverse biotopes in the wide surroundings, including field cultures. It was found on the area planned for building, on the route of the power output line and on the water mains route. The numbers of specimens, however, were not as high as observed during the past years (Bejček 2007), which may be due to the climatic extremes of this season.			

Species on the Red List of the Czech Republic

Endangered insect species included in the Red List of Endangered Species - Invertebrates have been detected in the examined territory (Farkač, Král & Škorpík 2005). In the text below, the site, type of occurrence and basic demands are specified for each species. Species included in the Red List of the Czech Republic as endangered species (EN), vulnerable species (VU) were found. In addition, 2 specimens of critically endangered species (CE) were observed by Bejček et al. in 2007.

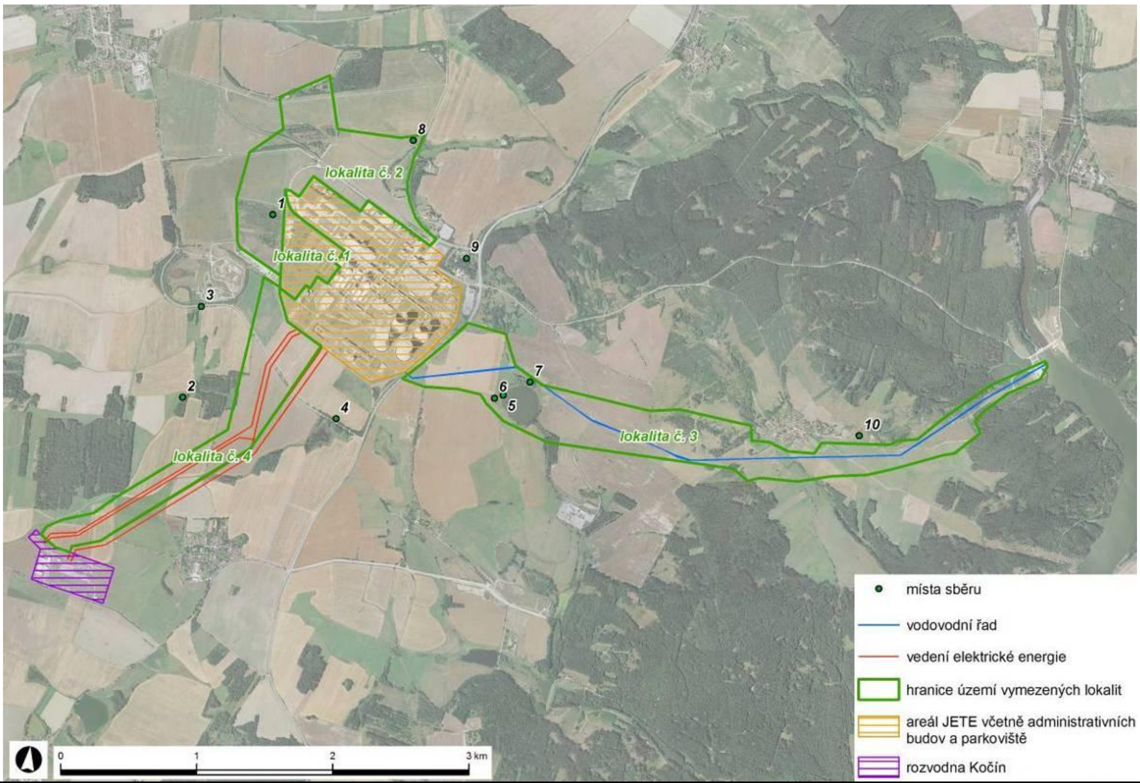
Table C.2.47: Overview of identified species included in the Red List of the Czech Republic

Latin name	English name	Decree 395/1992	Site
Lestes barbarus Fabricius, 1798	Southern Emerald Damselfly	VU	Sites 1, 2
A damselfly species bound to small, usually warm, shallow and grown biotopes, relatively resistant to water level fluctuations Its occurrence is island-like due to the loss of biotopes suitable for its development The presence of this species at the site examined is associated with the extensive wetland near the area, although adults can be found in the wide surroundings.			
Lestes dryas Kirby, 1890	Emeral Spreadwing Damselfly	VU	Sites 1, 2
A damselfly species whose demands are similar to those of the preceding species - shallow and rich still water biotopes, including slowly drying wetland. Its occurrence is rather mosaic-like, more abundant in South Bohemia than in the other parts of Bohemia. At the site examined, this damselfly develops in wetland ecosystems near the NPP Temelín area.			
Lestes virens Charpentier, 1825	Small Emerald Damselfly	VU	Sites 1, 2
Like the above species, this damselfly species prefers rather late succession stages of aquatic ecosystems, it is typical of smaller still water biotopes with well-developed swamp vegetation. Its occurrence is island-like in some parts of the country only, South Bohemia being one of its centres of occurrence. At the site examined, ties to the wetland ecosystems near the NPP Temelín area are apparent.			
Argogorytes mystaceus Linnaeus, 1761	(digger wasp)	EN	Sites 2, 4
Like other digger wasp species, this species is tied to open areas with scanty vegetation, sufficient amounts of food and space for holes. This species was found on heath vegetation in a forest ride.			
Polistes nimpha Christ, 1791		VU	Sites 1, 2, 3
Polistes bischoffi Weyrauch, 1937,		EN	Sites 1, 2
Polistine wasps are social wasps present at many types of open biotopes with sufficient amounts of food where they can nest. They can be typically found in ruderal habitats and other secondary biotopes. The two endangered polistine wasp species are present particularly on deponies and other drying-out surfaces near the NPP Temelín area, the P. bischoffi species was also observed on the route of the planned feeder. It is a species that was only recently identified within Czech fauna.			
Other species included in the Red List of the Czech Republic and found by Bejček et al. in 2007:			
Anoplius alpinobalticus		CE	Site 2
Anoplius caviventris		EN	
Dolichovespula media	Median Wasp	VU	Site 2
Dryudella femoralis		CE	Site 2
Episyron albonotatum		VU	Site 2
Hylaeus moricei		EN	Site 2
Lasioglossum majus		VU	Site 2
Megachile nigriventris		E	Site 2
Psenulus meridionalis		EN	Site 2
Rhopalum gracile		CE	Site 2
Sphecodes croaticus		EN	Site 2
Sphecodes rufiventris		VU	Site 2
Species on the Red List of the Czech Republic CE critically endangerd EN endangered VU vulnerable			

C.2.7.2.2.3. Malacology

Ten sites were selected in the area for sampling and observation, as shown below.

Figure C.2.85: Sites selected for the collection and analysis of occurrence of molluscs



Místa sběru	Points of collection
Vodovodní řad	Water mains
Hranice území vymezených lokalit	Boundary of delimited localities territory
Areál JETE včetně administrativních budov a parkoviště	TNPP complex including administrative buildings and parking lot

Overview of specially protected species and species deserving attention

No mollusc species specially protected under Act no. 114/1992 on the protection of nature and landscape (as amended) and Decree no. 395/1992 (as amended) have been identified in the area of the planned construction of the NNPP Temelín and its infrastructure.

The vulnerable Shining ram's-horn snail (*Segmentina nitida*) was observed in the Hůrecký Rybník pond, and the nearly endangered Lake fingernail clam (*Musculium lacustre*) was found at 2 sites. No other important species were observed.

C.2.7.2.2.4. Ichthyology

Two areas which may be potentially impacted by the construction of the new nuclear installation should be discriminated from the ichthyological aspect. The first group includes ponds, which form quite a dense network in the NPP Temelín surroundings but are hydrologically not associated with the plant or its operation. The ponds are not located in the area of the planned NNPP construction, their water sources will not be affected by water withdrawal for the operation of the existing and/or future nuclear reactors, nor will wastewater from the NNP Temelín and NNPP operation be drained into the ponds.

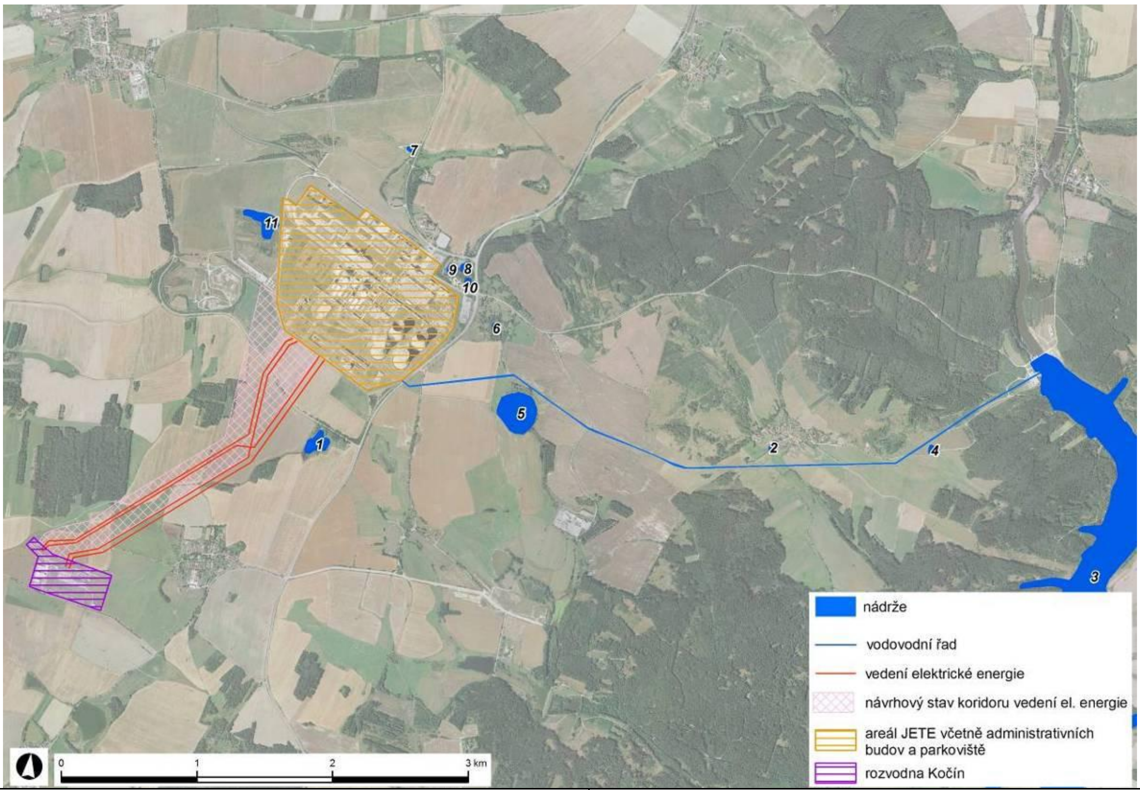
The survey was made on water reservoirs and ponds that will be directly or marginally affected by the project. No survey was organised in the remaining reservoirs.

Reservoir no. 1	Dvorčice pond
Reservoir no. 2	small reservoir in Litoradlice
Reservoir no. 3	Hněvkovice reservoir - see the Vltava River
Reservoir no. 4	small wetland with a small pool
Reservoir no. 5	Hůrecký Rybník pond

Reservoir no. 6 a small water reservoir
Reservoir no. 7 a small concrete reservoir
Reservoirs nos. 8, 9, 10 a system of 3 reservoirs in the park at the Information Centre
Reservoir no. 10 the largest local reservoir with an islet, with no littoral areas
Reservoir no. 11 wetland with 3 water areas

Apart from the reservoirs, hydrofauna was examined in the Vltava River, or in the Hněvkovice, Kořensko and Orlík reservoirs, because free river is virtually non-existent in the segment examined - or, in fact, only a short fragment has remained preserved downstream of the Hněvkovice reservoir.

Figure C.2.86: Water areas in the immediate vicinity of NPP Temelín



Nádrže	Tanks
Vodovodní řad	Water mains
Vedení elektrické energie	Power lines
Areál JETE včetně administrativních budov a parkoviště	TNPP complex including administrative buildings and parking lot
Rozvodna Kočín	Kočín switchyard

Overview of specially protected species and species deserving attention - water areas

No species specially protected under Decree no. 395/1992, species included in the Red List, or other fish species deserving attention from the protection/endangerment aspects were found within the survey of the relevant water reservoirs.

Overview of specially protected species and species deserving attention - the Vltava River

About 30 fish species are currently present in the Vltava segment of interest. In contrast to the past, still water species and species from the bream zone predominate in the numbers of specimens. The vast majority includes common representatives of Czech ichthyofauna, no rare or endangered species are present.

From among the fish species protected by law, the burbot (*Lota lota*) and the orfe (*Leuciscus idus*) live in the Vltava. Both fish species are planted into the river (Orlík reservoir) by sports fishermen within stocking plans. The question is whether the two fish species would occur in the river but for the regular planting. In view of their known biology and habitat demands, it seems likely that some numbers of both the burbot and the orfe would occur in the Vltava.

No species included in the Red List or other fish species deserving attention from the protection/endangerment aspects were identified in the Vltava.

Quality of the Vltava River water

Information regarding the current water quality in the Vltava River at Temelín was taken from publications by Hanslík et al. (2009) and Hejzlar et al. (2009). Impacts of the existing NPP Temelín operation was assessed for the period from 2000 till now taking into account the following parameters:

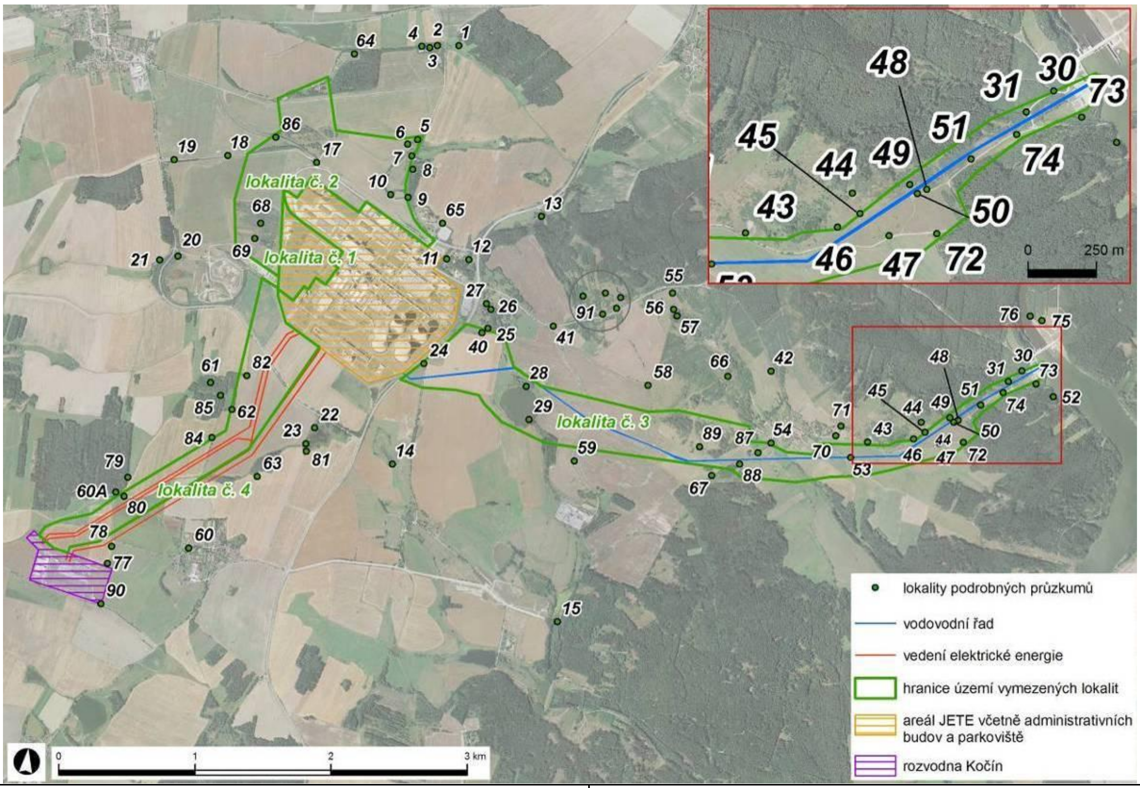
- Hydrological situation
- Physical parameters
- Chemical parameters
- Effects of radionuclides on the Vltava watercourse

For the results of assessment of the current plant operation on the Vltava water quality, refer to Section C.2.7.2.2.1 above. Hydrobiology

C.2.7.2.2.5. Herpetology

For the purposes of the herpetological examination, the NPP Temelín area and its surroundings were divided into 4 basic sub-areas, like for the other biological species, and a total of 90 partial sites were identified for a detailed examination of the presence of amphibians and reptiles.

Figure C.2.87: Photograph of the territory showing the sites selected for a detailed examination of the herpetofauna



Lokality podrobných průzkumů	Detailed survey localities
Vodovodní řad	Water mains
Hranice území vymezených lokalit	Boundary of delimited localities territory

Areál JETE včetně administrativních budov a parkoviště	TNPP complex including administrative buildings and parking lot
Rozvodna Kočín	Kočín switchyard

Overview of specially protected species and species deserving attention

An overview of the identified specially protected species and species included in the Red List of the Czech Republic is included in the table below.

Table C.2.48: List of identified specially protected animal and plant species included in the Red List

Latin name	English name	Decree 395/1992	Red List	Site
Anguis fragilis	Slow-worm	HE	LC	27,55,63
Bombina bombina	Fire-bellied toad	HE	LC	1,2,3,13,14,15,20,23,28,68,69,80,84
Bombina variegata	Yellow-bellied toad	HE	LC	5
Bufo bufo	Common toad	E	LC	2,3,5,22,30,41,42,52,54,55,60,60A,65
Bufo viridis	Green toad	HE		68,69
Coronella austriaca	Smooth snake	HE	LC	70
Hyla arborea	European tree frog	HE	LC	2,3,14,23,28,61,68,69,82
Lacerta agilis	Sand lizard	HE	LC	2,3,5,6,7,8,9,12,13,17,18,20,24,25,30, 31,40,43,44,45,46,48,49,50,51,52,56,58, 63,64,65,66,67,68,69,70,72,73,74,75,76, 77,78,82,86,88,89
Lacerta vivipara	Common lizard	HE	LC	2,3,19,60,60A,68,69,81,91
Natrix natrix	Grass snake	E	LC	2,3,12,13,49,50,52,60,60A,68,69
Pelobates fuscus	Common spadefoot	HE	LC	2,3,13,23,28,47
Rana dalmatina	Agile frog	HE	LC	1
Rana esculenta	Edible frog	HE		1,2,3,11,12,13,14,15,20,22,23,28,29,56, 60,60A,68,69,80,90
Rana lessonae	Pool frog	HE		2,3,14,23,47,68,69
Rana ridibunda	Marsh frog	CE		14
Rana temporaria	Common frog	-	LC	13,57,61
Triturus alpestris	(Triturus alpestris)	HE		2.3
Triturus cristatus	Great crested newt	HE	LC	5,47,68,69
Triturus vulgaris	Common newt	HE	LC	2,3,5,47,57,68,69
Species protection categories pursuant to Decree no. 395/1992: CE = critically endangered HE = highly endangered E = endangered Species included in the IUCN Red List: LC = species of least concern				

C.2.7.2.2.6. Ornithology

An ornithological survey was performed at sites no. 2, 3 and 4 (not within the NPP Temelín area). Except for minor exceptions, the 3 sites can be regarded as a single biotope. The exceptions include the forest near the Hněvkovice reservoir, with the occurrence of the black woodpecker and typical forest species of songbirds (such as the nuthatch). The small ponds and other water areas about the plant also host similar bird species.

A field survey gave evidence of the area hosting rather rich bird communities. The survey did not include any extraordinary observations, though, the species identified match the nature of the landscape, the relatively high species diversity is consistent with the mosaic-like landscape where birds find very diverse biotopes, from dry ruderal-type habitats (recultivated areas, material deponies) to field cultures, forests and groves, thickets to small ponds and wetland. Relatively high numbers of specially protected birds, including birds listed in Council Directive 79/409/EEC on the conservation of wild birds, were detected. However, as follows from detailed observations, many species only pass through the region and are not tied to it by nesting.

Overview of specially protected species and species deserving attention

Table C.2.49: List of specially protected species and species deserving attention

Latin name	English name	Decree no. 395/1992	Natura	Red List
Accipiter nisus	Eurasian sparrowhawk	HE		VU
Actitis hypoleucos	Common sandpiper			VU
Alauda arvensis	Skylark		II	
Anas crecca	Common teal	E		
Anas strepera	Gadwall	E	II	VU
Apus apus	Common swift	E		
Ardea cinerea	Grey heron			NT
Aythya ferina	Common pochard		II, III	
Aythya fuligula	Tufted duck		II, III	
Circus aeruginosus	Marsh harrier	E	I	VU
Columba palumbus	Woodpigeon		II, III	
Cygnus olor	Mute swan		II	
Delichon urbica	House martin			NT
Dryocopus martius	Black woodpecker		I	
Egretta alba	Great white egret		I	
Fulica atra	Eurasian coot		II, III	
Gallinula chloropus	Common moorhen		II	
Hirundo rustica	Barn swallow	E		LC
Charadrius dubius	Little ringed plover			EN
Lanius collurio	Red-backed shrike	E	I	NT
Larus ridibundus	Black-headed gull		II	VU
Oriolus oriolus	Golden oriole	E		
Passer domesticus	House sparrow			LC
Passer montanus	Tree sparrow			LC
Perdix perdix	Grey partridge	E	II, III	NT
Podiceps cristatus	Great crested grebe	E		
Saxicola rubetra	Whinchat	E		LC
Streptopelia decaocto	Collared dove		II	
Tachybaptus ruficollis	Little grebe	E		VU
Turdus merula	Common blackbird		II	
Turdus philomelos	Song thrush		II	
Tyto alba	Barn owl	HE		

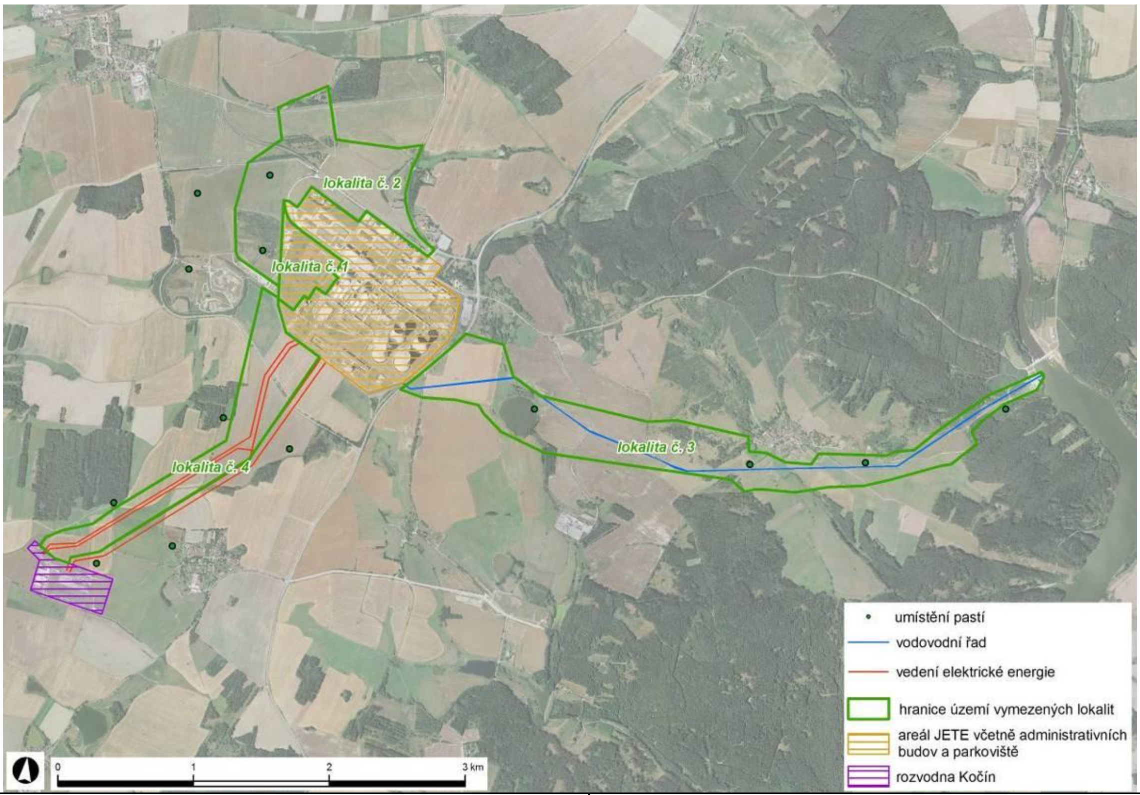
Species protection categories pursuant to Decree no. 395/1992:
HE = highly endangered
E = endangered
Species included in the IUCN Red List:
EN = endangered species
VU = vulnerable species
NT = near threatened species
LC = species of least concern
Species listed in Annexes to Council Directive 79/409/EEC on the conservation of wild birds:
I = protected species
II = protected species than may be hunted under certain conditions
III = protected species that may be marketed under certain conditions

C.2.7.2.2.7. Mammaliology

The map below shows the areas and site where traps for the capture of small rodents were laid. A field survey of mammals was performed at sites no. 2, 3 and 4. No survey was performed inside the fenced NPP Temelín area.

Most of the sites are similar in nature, with minor exceptions. The nature of the biotope and occurrence of species are different especially in the forest at the Hněvkovice water reservoir (within area no. 3), with its forest species (badger), and the extravilan of towns and villages, where synanthropic species (i.e. species accompanying humans), such as the rat, are present. The small waterlogged and wet areas around NPP Temelín also have the same fauna of birds and mammals.

Figure C.2.88: Map of the area under study with the siting of traps for the capture of mammals



Umístění pastí	• Trap locations
Vedení elektrické energie	Power lines
Hranice území vymezených lokalit	Boundary of delimited localities territory
Areál JETE včetně administrativních budov a parkoviště	TNPP complex including administrative buildings and parking lot
Rozvodna Kočín	Kočín switchyard

Overview of specially protected species and other species deserving attention

Only two mammal species of some significance from the environmental protection aspect were identified in the whole examined area. They are the Eurasian red squirrel (*Sciurus vulgaris*), a specially protected species included in the category of endangered species pursuant to Decree no. 395/1992, and the European polecat (*Mustela putorius*), a species included in Category DD of the IUCN Red List (lack of data for the assessment of the degree of endangerment).

The occurrence of the common otter (*Lutra lutra*), a specially protected species in the Highly Endangered category pursuant to Act no. 114/92 on the protection of nature and landscape (as amended), at the Vltava and the Hněvkovice, Kořensko and Orlík reservoirs can be expected. Nevertheless, it was not detected within the 2009 survey.

C.2.7.3. Specially protected areas and Natura 2000 sites

The area of interest lies beyond specially protected areas and does not directly touch any component of the Natura 2000 system or any UNESCO biosphere reserves, Ramsar wetland sites or other areas of importance from the international point of view.

A single specially protected area and two sites within the Natura 2000 system lie within 10 km of NPP Temelín and the planned NNPP:

- The Velký Kamýk and Malý Kamýk PR (Natural Reserve), approximately 7.6 km to the northwest,
- Hlubocké Hory EVL (European Important Area) and PO (Bird Area), approximately 7.4 km to the southeast,

- Lužnice and Nežárka EVL, approximately 5.2 km to the north.

The Dvorčice pond, referred to as a historical monument in some documents, is located in an immediate vicinity to the existing NPP Temelín area (approximately 500 m to the south). This area, however, has not yet been granted the statute of a specially protected area under Section 14 of Act no. 114/1992 on the protection of nature and landscape (as amended). Its inclusion in the "natural historical monument" category, however, is under preparation. The area is valuable particularly owing to the occurrence of the Siberian Iris (*Iris sibirica*), aquatic birds and amphibians. This area will not be directly affected by the project.

Other areas are located farther than 10 km from NPP Temelín. The nearest of them are the following:

- Radomilická mokřina EVL and PR, approximately 10.2 km to the southwest
- Černická obora PP (Natural Historical Monument), approximately 18.0 km to the northeast
- Libochovka PR, 13.2 km to the south-southeast
- Žďárské louky EVL and PP, approximately 11.5 km to the northwest.

The boundary of the Třeboňsko Protected Landscape Area (CHKO) is located approximately 18 km to the southeast. This Protected Landscape Region is also a biosphere reserve and includes two Category I Ramsar wetland sites.

The boundary of the Blanský Les Protected Landscape Area is located approximately 26 km to the northwest.

The boundaries of the Šumava CHKO and Šumava NP (National Park) are 44 and 55 km, respectively, far from the plant. Šumava is also a UNESCO biosphere reserve and includes Category I Ramsar wetland sites, which are peat bogs.

C.2.7.4. Territorial system of ecological stability and other elements of protection

C.2.7.4.1.Territorial system of ecological stability

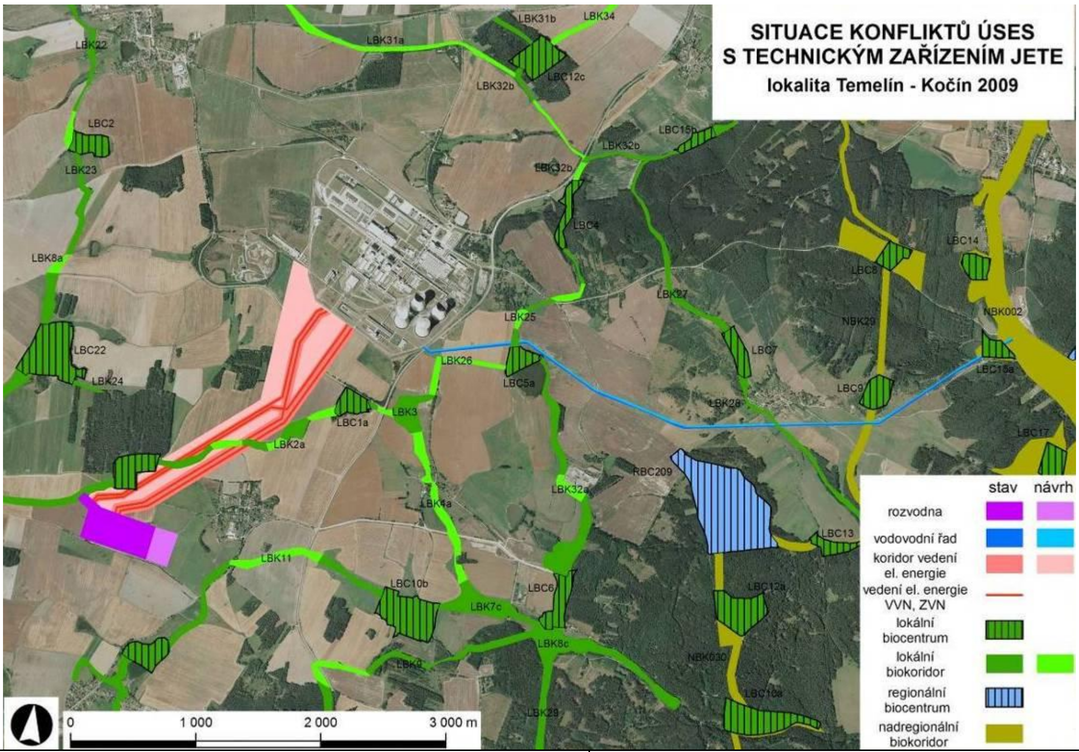
No elements of the Territorial System of Ecological Stability (TSES) at the supraregional, regional or local level have been defined or proposed within the area of the project. Elements of the regional and supraregional ecological stability systems are more than 5 km far from the plant area. Elements of the system at the local level only occur in the plant's near vicinity.

An overview of the elements of the TSES is presented in the table below, the location of the elements is visualised in the map segment.

Table C.2.50: List of TSES elements near NPP Temelín and the planned NNPP

TSES element	Name	TSES element	Name
Local biocorridors		Local biocentres	
LBK 2a	Malešický Brook	LBC 1a	Dvorčice
LBK 3	Karlovec	LBC 2	Za Humny
LBK 4a	Knín	LBC 4	Podhájnice
LBK 5	Starý Rybník	LBC 5a	Hůrecký Rybník
LBK 7c	Strouha II	LBC 6	Pod Býšovem
LBK 8a	Temelínský Brook I	LBC 7	Hradní Strouha - Tankáč
LBK 8c	Strouha III	LBC 8	K Přehradě
LBK 9	Nad Strouhou	LBC 9	Litoradlice
LBK 11	Strouha I	LBC 10b	Zlatnice
LBK 22	Temelín	LBC 12a	Vápenice II
LBK 23	Temelínský Brook	LBC 15b	U Palečků
LBK 24	Na Padělkách	LBC 15a	Studený Brook
LBK 26	Palečkův Brook	LBC 22	V Mokřinách
LBK 25	Hrádecký Rybník tributary	Regional biocentres	
LBK 27	U Pištory	RBC 209	Janoch
LBK 28	Hradní Strouha	Supraregional bio-corridors	
LBK 29	Coufalka	NBK 29	Klapačka
LBK 32a	Strouha	NBK 2	Vltava
LBK 32b	Palečkův Brook II		

Figure C.2.89: TSES situation near NPP Temelín



SITUACE KONFLIKTŮ ÚSES S TECHNICKÝM ZAŘÍZENÍM JETE	SITUATION PLAN OF CONFLICTS BETWEEN TERRITORY ECOLOGICAL STABILITY SYSTEM AND TNPP TECHNICAL FACILITIES
Lokalita Temelín – Kočín 2009	Temelín - Kočín locality - 2009
Stav	Current
Návrh	Proposed
Vodovodní řad	Water mains
Koridor vedení elektrické energie	Power lines corridor
Vedení elektrické energie VVN, ZVN	Power lines VHV, SHV
Lokákní biocentrum	Local bio centre
Lokální biokoridor	Local bio corridor
Regionální biocentrum	Regional bio centre
Nadregionální biokoridor	Superregional bio corridor

C.2.7.4.2.Important landscape elements

No important landscape elements as defined by Section 6 of Act no. 114/1992 on the protection of nature and landscape (as amended) have been registered at the new nuclear installation construction site or in its surroundings.

Pursuant to the definition in Section 3 of Act no. 114/1992, all forest stands, watercourses, ponds and floodplains in the surroundings are important landscape elements.

C.2.8. Landscape

C.2.8.1. Landscape features

The area from which NPP Temelín is visible in certain conditions encompasses virtually the entire South-Bohemian Administrative Region (except for the eastern part of the Dačice area) and extends across the boundaries of the Plzeň Region, Central Bohemian Region, Vysočina Region and the national border with Austria. For the purposes of description and assessment of the landscape features, this extensive and highly variable area was divided (based on the use of digital models to assess the visual effects of the planned project) first into an inner circle and an outer circle and, subsequently, into smaller affected landscape units. In order to avoid unnecessary conflicts of the different concepts and the ambiguities following from them, the identification of the landscape areas in the General Scope of the Landscape Features of the South-Bohemian Region (Vorel et al. 2009) was used as the basis for this division. The area assessed (including potentially affected parts of Austria) was thus divided into a total of 44 affected landscape units (ALU), of which 12 ALUs are in the inner circle and 32 ALUs in the outer circle.

The first evidence of settlement activities in the defined territory originates from the Middle Paleolithic period. Rather permanent occupation, however, following Mesolithic and Neolithic episodes, only occurs in the Early and Middle Bronze Ages (the Únětice and Bohemian - Pfalz barrow culture - Pleiner, Rybová et al. 1975). The population of those cultures penetrated into the region along the then already consolidated roads of at least Central European importance. The interconnection of the region and surrounding Europe deepened still in the Hallstatt period and the following La Tene period. The South-Bohemian region (and, in fact, the entire Bohemia) became a component of a wider area of etnogenesis of Celtic tribes and of the subsequent development and virtually Europe-wide expansion of their civilisation (Waldhauser 2001).

Following a certain settling hiatus in the Roman era (sparse and insignificant German population), the 7th Century saw the Slavic population begin penetration into the region from the Danube basin (Albrecht et al. 2003) and probably also from central Bohemia (Vorel et al. 2009). During the coming history, the region became a part of the emerging Czech state ruled by the Přemyslides, who built a network of mighty castles (or, at the beginning, fortified settlements) there, on the periphery of their space of interest. The castles stimulated the emergence of many regional settlement centres which became the basis of the territory's future settlement structure (Netolice, Chýnov, Doudleby, Prácheň). The power struggles for the rule over Bohemia occurred elsewhere and the South-Bohemian region thus got somewhat off the focus of the ruling family. The consequences included a gradual forming of the domestic South-Bohemian nobility and increase in the interest in the south of Bohemia by foreign, especially Bavarian and Austrian, nobility and by the church. The three power groups started extensive colonisation in the 12th century, using the services of professional locators. The Přemyslides joined those efforts only in the 13th century, more in a defensive reaction and in attempts to preserve the remnants of their influence at least. In this manner the settlement-and-road structure of the territory, as still found today, was established between the 12th and 14th centuries. All of the important towns were then founded (except for the Hussite town of Tábor, which is a specific case), including the royal cities established in order to outweigh the power of the regional nobility (České Budějovice, Sušice) and monasteries (Milevsko, Zlatá Koruna, Vyšší Brod). The initially scattered settlement of the rural landscape concentrated into colonisation villages, mostly elongated or radial type (Albrecht et al. 2003), and more and more of the original virgin land was cultivated.

From among the colonists, the German Order of Knights is worth mentioning. They brought with them the knowledge of freshwater fish farming, thus laying the basis of the South-Bohemian fish farming industry as one of the decisive phenomena of the region's landscape patterns.

The promising development was interrupted by the Hussite wars era and could only be continued in the late 15th century. The whole 16th century was one of the periods of bloom in this region. The Rožmberk family particularly succeeded in building a practically self-sufficient state within the state. The Rožmberk dominion was perfectly organised both bureaucratically and economically by hiring good managers. A considerably large part of the entrepreneurial activities had quite a marked impact on the region's landscape patterns, both favourable and unfavourable. Among the favourable activities was, in particular, the building of a system of fish-farming ponds, which still determine the nature of a large part of the South-Bohemian landscape. Among activities with adverse impacts on the landscape was the glass industry with its high demands for wood. This resulted in appreciable changes in the species composition of forests leading to today's monocultures or to a complete deforesting of extensive mountain areas. Ore mining was another field of activity having adverse impacts on the landscape. This industry also needed large amounts of wood and, in addition, altered the morphology of the ground in some landscape segments and contaminated the environment, watercourses in particular, with ore processing waste products. Remains of mining from the Middle Ages and early modern times are still apparent in some areas, however, their role is rather favourable: the montanistic relics grown with trees and shrubs often act as sporadic dividing elements in the otherwise uniform agricultural landscape.

The development of the region was interrupted once again by the Thirty Years' War, which also brought about appreciable change in the power situation and increased the role of new noble families. The new nobilities (particularly the Buquoy, Eggenberg and Schwarzenberg families), however, followed the Rožmberk tradition and, especially after the economic recovery during the reign of Maria Theresa, associated with the building of a network of imperial roads, built up similarly functioning and economically self-sufficient dominia, however, now it was not so much “off-the-state”. In reaction to the previous Hussite “heresy” and the subsequent era of relative religious freedom, intensive re-catholicisation took place, manifesting itself in the landscape by rebuilding many churches and other church-owned buildings in the Baroque style and by building a number of landscape compositions related to important places of pilgrimage (Římov, Dobrá Voda, Lomec, Svatá hora u Příbrami, Sepekov, ...). Similar landscape compositions, but of secular nature and purpose, also emerged in relation to important nobility manors or hunting castles (Libějovice, Černická obora, Hlubocko, Červená Lhota, Jemčina, ...).

Even after the abolishment of serfdom and slow advent of industrial revolution, the south of Bohemia remained a predominantly agricultural area. In spite of the rather successful efforts of the estate owners in the region, the region did not provide sufficient job opportunities, and a significant fraction of the population migrated to other parts of the monarchy or emigrated to America. The situation partly changed with the construction of railways, first the horse-drawn railway between České Budějovice and Linz (1825-1828) and subsequently the classical railways: 1868 Plzeň - České Budějovice, 1873 Prague - Gmünd. However, despite the gradual development of the railway network, historical industrialisation of the region was confined to larger cities, particularly České Budějovice and, to a lesser extent, Tábor, Písek, Sušice and Strakonice. The Příbram ore mining area was a specific case, of marginal importance to the region in question. The spectrum of industries was also limited: the brewing industry, wood processing industry, manufacture of matches, manufacture of textiles and accessories, manufacture of pencils.

Apart from the above-mentioned historical wars, conflicts of the modern times also affected the region, not by direct combat actions, but by their aftermaths. The emergence of the Czechoslovak Republic as a consequence of World War I was associated with rather tense national relations in the border areas with a strong German minority. The subsequent development, affected by the situation in Germany between the two World Wars, climaxed during World War II and shortly thereafter, when the population of German nationality, whose proportion had been prevailing or at least very high, was resettled from the rather extensive border areas of the region. In this manner a significant fraction of the region was depopulated to a large extent within a short period of time, and the numbers of population were never restored again. In fact, after the establishment of a frontier zone and militarisation of the borderlands during the cold war, the repopulation of the relatively broad borderland region was undesirable.

As a consequence, the settlement structure thinned appreciably in the affected areas, a number of villages and small towns disappeared, and the remaining population concentrated in larger villages and towns. The initial scattered buildings virtually vanished from the landscape and the initially densely built villages became scattered landscape objects. In the free landscape of the borderlands, a fraction of the initially farmed land was afforested again, another fraction entered the possession of socialistic agricultural enterprises. The initially extensive farming on small areas was transformed into intensive use of consolidated large areas, although this concept of agriculture was unsuitable for this region. Technicisation of the area, caused by a network of military facilities, was also marked. Spontaneous renaturalisation of some segments of the abandoned cultural landscape can be looked upon as a favourable contribution of this otherwise unfavourable development.

The socialistic era of the history of the region appreciably affected the remaining areas of the region as well. In the parts of the landscape which were used for farming, the initial extensive farming of small areas was transformed into intensive large-area farming which was nearly of industrial nature. This intensive use of the landscape led to a degradation of the landscape patterns, particularly through the consolidation of fields, removal of minor landscape elements, regulation of watercourses (associated with a removal of bank vegetation), draining of extensive areas, elimination of field paths etc. The number of scattered buildings on the free landscape also decreased.

Inside towns and villages, many old buildings gave way to devastation or did not suit the period style and were rebuilt or replaced with buildings in a style emphasising their use functions at the expense of aesthetic effect and acceptable size parameters. Towns (even smaller ones) were surrounded by housing estates which often penetrated deeply into the historical centres. Prefab buildings were also built in villages. Architecturally non-contextual culture houses and shopping centres in villages also point to their urban models. Oversize agricultural areas strictly designed to serve its purpose, often situated in rather conspicuous locations, became an apparent element of the majority of villages and towns. Starting roughly in the 1950s, some parts of the region were industrialised to a large extent (the České Budějovice, Písek, Strakonice and Tábor districts). This regional process was part of nationwide industrialisation efforts focused on development of the energy-demanding heavy industries. This brought about two very marked interventions into the region's landscape patterns: construction of dams, and construction of the Temelín Power Plant.

Some of the above-mentioned adverse processes have persisted, in a modified form, till the present (gigantic halls of extensive industrial, storage and shopping zones on the outskirts, catalogue family houses also in small towns and villages, ...). However, a mere comparison of old photographs (including those in official publications) with the present state, however, reveals that the care of historical heritage in the landscape has been improving. Currently, historical heritage in the region is protected within 5 historical landscape zones, 1 archaeological reserve, several dozen urban and rural historical zones and reserves, 2 of which are also on the UNESCO world heritage list (Český Krumlov, Holašovice), and the governmental list of immovable historical monuments includes nearly 6,000 items in the region.

Typology of the region:

- From the settlement aspect, the majority of the area is high Middle Age settlement landscape, fringed by late Middle Age landscape at higher altitudes of the peripheral mountains and in the Třeboň basin and by a modern day landscape in the top areas of the Šumava.
- From the relief aspect, a hilly landscape predominates, forming marked slopes and rocky crests at the higher altitudes of the peripheral mountains (particularly in the Novohradské Hory - Šumava zone) and high-lying plateaux in the top parts of the Šumava. The landscape of the Třeboň basin consists of plains; open parts of river valleys are broad flood plains; and landscape of incising valleys is also present.
- From the land use aspect, forest-field landscape prevails, interspersed with forest landscape, agricultural landscape and extensive areas of pond landscape. Segments of urbanised landscape are rather sparse.

It follows from the text above that, despite some peripeteia of the historical and current development, the South-Bohemian region, seated inside a ring of forested mountains and separated thus to some degree from the remaining area of Bohemia, preserved its specific features acquired from a history dating back to the Middle Ages. Also, it is clear that the region is highly varied from the points of view of both the natural frame and the historical processes of landscape development. Equally varied are the landscape patterns of the sub-areas, defined as affected landscape units for the purpose of this assessment.

C.2.9. Tangible property and cultural heritage

C.2.9.1.Tangible property

No immovable tangible property owned by third parties (houses, buildings or other structures) are present in the area where the construction of the new nuclear installation is planned.

The villages of Březí, Knín, Křtěnov, Podhájí u Týna nad Vltavou and Temelínec and many communal and other buildings vanished due to the former construction of the Temelín Power Plant.

The Hlinky housing estate with residential houses was built in Týn nad Vltavou, and other homes (terraced houses in Neznašov, family houses in Hluboká nad Vltavou, a part of the Máj estate in České Budějovice, Uran staff quarters in České Budějovice) were built for or made available to Temelín plant employees who moved into the area.

C.2.9.2. Cultural and historical heritage

C.2.9.2.1. Architectural monuments and historical heritage

Immovable cultural monuments covered by Act no. 20/1987 on state care of historical heritage and monuments (as amended) and included in the Central List of Cultural Monuments of the Czech Republic exist in Všemyslice, Dříteň, Olešník, Temelín, Týn nad Vltavou and Nákří.

Architectural monuments covered by the Act and located in towns/villages in the area studied are listed in the table below.

Table C.2.51: Immovable cultural heritage monuments in the study area

Town/village	Part	Monument
Dříteň	Dříteň	St. Dismas Church (Registry item no. 90)
	Dříteň	St. John of Nepomuk statue (Registry item no. 91)
	Dříteň	Castle (Registry item no. 89)
	Chvalešovice	Fort (Registry item no. 172)
	Libív	Wayside cross (Registry item no. 92)
	Malešice (Bílá Hůrka)	St. Stephen Church (church building, cemetery with wall, bell tower, morgue, entrance gates, the Virgin Mary of Lourdes alcove chapel) (Registry item no. 173)
	Radomilice	Schwarzenberg farm (Registry item no. 381)
	Záblatí	Alcove chapel (Registry item no. 562)
	Záblatí	Farmhouse (Registry item no. 561)
	Záblatíčko	St. Adalbert Church with chapel (Registry item no. 563)
Olešník	Chlumec	Farmhouse (Registry item no. 166)
	Nová Ves	Chapel (Registry item no. 6176)
Temelín	Lhota pod Horami	Farmhouse (Registry item no. 457) This cultural monument does not physically exist anymore. Proposal for cancellation was submitted in June 2008, the procedure has not been completed yet.
	Litoradlice	Schwarzenberg boundary stone (Registry item no. 238)
	Sedlec	Alcove chapel (Registry item no. 419,*37)
	Sedlec	Farmhouse (Registry item no. 418)
	Temelín	Farmhouse (Registry item no. 458)
Týn nad Vltavou	Hněvkovice, left bank of the Vltava	Farmhouse - granary only (Registry item no. 5300)
	Koloděje nad Lužnicí	St. John of Nepomuk chapel (Registry item no. 200)
	Koloděje nad Lužnicí	Jewish cemetery (Registry item no. 202)
	Koloděje nad Lužnicí	Matěj Kopecký sculpture (Registry item no. 203)
	Koloděje nad Lužnicí	Castle (castle, chapel, park, farm houses) (Registry item no.197)
	Koloděje nad Lužnicí	Granary (Registry item no. 199)
	Nuzice	Road bridge - small bridge (Registry item no. 5616)
	Týn nad Vltavou	Castle (Registry item no. 492)
	Týn nad Vltavou	Inn (Registry item no. 6005)
	Týn nad Vltavou	St. James Church (Registry item no. 508)
	Týn nad Vltavou	St. Vitus Church (Registry item no. 509)
	Týn nad Vltavou	Fortified building - set of underground constructions (Registry item no. 101920)
	Týn nad Vltavou	Virgin Mary statue (Registry item no. 511)
	Týn nad Vltavou	Virgin Mary statue (Registry item no. 511)
	Týn nad Vltavou	St. Franciscus Xaverius statue (Registry item no. 513)
	Týn nad Vltavou	Calvary sculpture (Registry item no. 514)
	Týn nad Vltavou	Road bridge (Registry item no. 5884)
	Týn nad Vltavou	Castle (Registry item no. 493)
	Týn nad Vltavou	Town hall (Registry item no. 502)
	Týn nad Vltavou	Salt house (Registry item no. 516)
	Týn nad Vltavou	Town houses (Registry items no. 501, 500, 5659, 5660, 5661, 5662, 5663, 5664, 497, 498, 494, 495, 505, 506, 507, 6095)
	Týn nad Vltavou	U Zeleného Věnce pub (Registry item no. 496)
	Týn nad Vltavou	Deanery (Registry item no. 510)
	Týn nad Vltavou	Zlatá loď hotel (Registry item no. 504)
	Týn nad Vltavou	Modrá hvězda town house (Registry item no. 503)

Všemyslice	Neznašov	Trinity Church (Registry item no. 557)
	Neznašov	Small chapel (Registry item no. 558)
	Neznašov	Jewish cemetery (Registry item no. 6076)
	Neznašov	Count Bertold family funeral chapel (Registry item no. 5267)
	Neznašov	Wayside shrine (Registry item no. 559)
	Neznašov	Town house (Registry item no. 556)
	Neznašov	Castle (Registry item no. 555)
	Neznašov	Ore mine - gallery only (Registry item no. 6018)
Nákří	Nákří	St. Peter and Paul Church with cemetery and parish house no. 21 (Registry item no. 273)

The following villages (nearly) vanished due to the construction of the power plant: Březí u Týna nad Vltavou, Knín, Křtěnov, Podhájí a Temelínec. Monuments protected under the cited law, however, remained preserved in Březí near Týn nad Vltavou and Knín and also in Kočín.

Figure C.2.90: Selected immovable cultural monuments in the region in question


Březí nad Vltavou
St. Procopius Church (Reg. no. 212)


Knín
Býšov fort (Reg. no. 190)


Kočín
Farmhouse (Reg. no. 192)

Some monuments which, although not covered by Act no. 20/1987 Coll., are of architectural value and remained preserved in the defunct villages of Březí nad Vltavou, Podhájí and Knín. They are: St. John of Nepomuk alcove chapel, Holy Virgin Mary of Lourdes chapel in Březí nad Vltavou, St. John of Nepomuk chapel in Podhájí, and St. Wenceslaus chapel in Knín.

Figure C.2.91: Selected architectural monuments in the area studied


Březí nad Vltavou


Březí nad Vltavou


Podhájí


Knín

The Vysoký hrádek - Březí small castle is another cultural monument which is neither covered by Act no. 20/1987 Coll. nor included in the Central List of Cultural Monuments. This castle lies in the close neighbourhood of the Temelín Power Plant and accommodates the power plant Information Centre. In 1998, the ČEZ utility was granted a Diploma of Merit by the Czech Ministry of Industry and Trade, the Association of Building Entrepreneurs of the Czech Republic, the Stavitel journal (issued by Economia a.s.) and by the ABF Foundation for the Development of Architecture and Civil Engineering, in recognition of a sensitive reconstruction and completion of this significant historical monument with respect to its new functional use.

Figure C.2.92: Selected architectural monuments in the area studied


Březí nad Vltavou
Vysoký Hrádek castle


Březí nad Vltavou
Vysoký Hrádek castle

C.2.9.2.2. Archaeological sites

Immovable archaeological monuments in the study area (Temelín Power Plant surroundings) included in the Central List of Immovable Cultural Monuments can be classed in the following categories:

Barrow burial grounds

Barrow burial grounds occupy the first place with respect to their extent and importance. They are sites whose objects (barrows) accommodate the dead persons' bones and grave equipment. Such sites inform us both about the funeral rite and about the material culture of the deceased inhabitants of the area. They are clay or clay-stone fills of the shape of circular segments or truncated cones, very low today and sometimes nearly indiscernible in the free landscape. The barrows include stone or wood grave structures or just simple graves without any lining. Barrow burial grounds used to be founded on hills or mild slopes at 380-700 m altitudes. They were first built in the Early Bronze Age and then, especially, during the Hallstatt and La Tene periods. The last to bury their dead under barrows were the Slavs in the 7th to 9th centuries A.D. Secondary burials, i.e. burials into existing older barrows, were practised in the Hallstatt and La Tene and Slavic periods.

The Únětice culture is one of the best-known cultures of the Early Bronze Age. The dead were then also buried into flat graves, and only the Middle Bronze Age was a genuine barrow culture. The Late Bronze Age was a period of the Milaveč culture. The Hallstatt and La Tene cultures, the culture of the Celtic population in this territory, fall in the Early Iron Age. Our Slavic ancestors were the last to bury their dead into barrows. Therefore, the sites listed below can be classed in several categories.

Knín - Reg. no. 191, 5539
Kočín - Reg. no. 5476 (La Tene)
Březí near Týn nad Vltavou - Reg. no. 5499 (Hallstatt)
Křtěnov - Reg. no. 214 (Hallstatt)
Litoradlice - Reg. no. 5275, 5521 (Early Bronze), 5522 (Early Bronze), 5276, 5973
Temelínec - Reg. no. 5588 (La Tene, prehistory)
Týn nad Vltavou - Reg. no. 5279 (Hallstatt)
Slavětice - Reg. no. 5557
Všeteč - Reg. no. 5562, 5563, 5564
Březí near Týn nad Vltavou - Reg. no.5979 (pagan agricultural prehistory - not otherwise specified)
Týn nad Vltavou - Reg. no. 280, 5281, 5565 (pagan agricultural prehistory - not otherwise specified)
Hněvkovice - Reg. no. 5566 (pagan agricultural prehistory - not otherwise specified)
Koloděje - Reg. no. 5285, 5551 (pagan agricultural prehistory - not otherwise specified)
Nuzice - Reg. no. 5268, 5269 (pagan agricultural prehistory - not otherwise specified)
Všemyslice - Reg. no. 5285, 5283, 5284, 5560 (pagan agricultural prehistory - not otherwise specified)

Hill forts

Hill forts - fortified prehistoric and partly historical strategically located sites protected by a complex system of earthwork (ramparts made of stone, earth and wood) and ditches, constitute the next type of archaeologically important sites. They were located both in free landscape and on the edges of terraces above river and brook valleys, on promontories above river meanders or on hills, making use of the natural formations to complete them to a fortification. Earlier forts (the Bronze - La Tene era) have a rather simple ground plan (circular to oval or triangular with a single ditch), whereas forts from the Slavic period were internally divided by as many as 3 fortification strips, so that the acropolis (castle) itself remained separated from the front section. Sometimes, older forts were also made use of during later periods. Forts in the region studied have been little examined so far, and so precise historical dating is impossible and available information is based on earlier research and random findings.

Litoradlice - Reg. item no. 239 - late Hallstatt, La Tene - fort period
Týn nad Vltavou - Reg. item no. 5597 - Hallstatt - early Middle Ages
Koloděje nad Lužnicí - Reg. item no. 5595 - early Middle Ages, fort period
Nuzice - Reg. item no. 5302 - Hradec - Hallstatt - Middle Ages
Všemyslice - Reg. item no. 5272 - Bronze Age - Middle Ages
Neznašov - Reg. item no. 5596 - prehistoric times - Middle Ages

Strongholds

Strongholds and forts constitute the next type of archaeological sites, remains of gentry seats from the Early Middle Ages. Their origin can be dated back mainly to the 13th and 14th century, although they were used during the later centuries as well. They are lowland or elevated strongholds located at the periphery of towns or villages or directly in their centres. Only strongholds from the high Middle Ages, i.e. from the 13th to 15th centuries, have an archaeological explanatory power.

Sedlec - Reg. item no. 5604
Chvalešovice - Reg. item no. 172

Vanished castles (ruins), such as Týn nad Vltavou - Reg. item no. 515, can be added to the above sites as well.

Gold panning sites, mines

The last type of archaeological sites to mention here include gold panning sites and mines. They are dump heaps consisting of gravel, sand and clay formed by the build-up of the material originally containing small strips and grains of gold or another noble metal. Gravel mining in recent years destroyed many of the sites, and therefore they have been included among archaeological heritage and examined thoroughly. Findings from panning sites, especially fragments of ceramics, can help us identify the period of the mining activity. Raw material extraction by this method was practised here from the Late Bronze Age to the 16th century A.D., when gold also started to be extracted by deep mining. Such primary (exploited) gold deposits - gold mines (shafts, drifts, pit tips) exist in the surroundings of the Temelín Power Plant.

Neznašov - Reg. item no. 6018 (drift)
Všeteč - Reg. item no. 5612 (gold panning heaps)
Všeteč - Reg. item no. 5613 (Kometa gold mines)

The table below lists all archaeological sites covered by Act no. 20/1987 Coll. on state care of historical monuments (as amended) existing in the area.

Table C.2.52: Archaeological sites in the study area

Site	Part of the town/village	Monument
Dříteň	Záblatíčko	Panning sites - heaps, archaeological traces (Reg. item no. 5614)
Olešník	Chlumec	Barrow ground, archaeological traces (Reg. item no. 5270, 5271, 5273)
	Nová Ves	Barrow ground, archaeological traces (Reg. item no. 5501, 5526, 5500)
Temelín	Březí near Týn n.Vl.	Barrow ground, archaeological traces (Reg. item no. 214)
	Březí near Týn n.Vl.	Barrow burial ground (Reg. item no. 5479, 5499)
	Knín	Barrow ground, archaeological traces (Reg. item no. 5539)
	Kočín	Barrow ground, archaeological traces (Reg. item no. 5476)
	Litoradlice	Barrow ground, archaeological traces (Reg. item no. 5276, 5521, 5473, 5275, 5522)
	Litoradlice	Elevated fortified settlement - Na Hradu fort, archaeological traces (Reg. item no. 239)
	Sedlec	Fort, archaeological traces (Reg. item no. 5604)
	Temelín	Barrow ground, archaeological traces (Reg. item no. 5588)
Týn nad Vltavou	Koloděje nad Lužnicí	Barrow ground, archaeological traces (Reg. item no. 5285, 5551)
	Koloděje nad Lužnicí	Elevated fortified settlement - Na Hradci fort, archaeological traces (Reg. item no. 5595)
	Nuzice	Barrow ground, archaeological traces (Reg. item no. 5269, 5268)
	Nuzice	Elevated fortified settlement - Hallstatt and medieval fort, archaeological traces (Reg. item no. 5302)
	Týn nad Vltavou	Barrow ground, archaeological traces (Reg. item no. 5566, 5279, 5565, 5281, 5280)
	Týn nad Vltavou	Elevated fortified settlement - Na Hradu fort, archaeological traces (Reg. items no. 515, 5597)
Všemyslice	Všemyslice	Barrow ground, archaeological traces (Reg. items no. 5560, 5284, 5282, 5283
	Všemyslice	Plane fortified settlement, archaeological traces (Reg. item no. 5272)
	Slavětice	Barrow ground, archaeological traces (Reg. item no. 5557)
	Všeteč	Panning sites - heaps, archaeological traces (Reg. item no. 5612)
	Všeteč	Zlatodoly gold mine, archaeological traces (Reg. item no. 5613)
	Všeteč	Barrow ground, archaeological traces (Reg. items no. 5563, 5562, 5564, 5561)

	Neznašov	Barrow ground, archaeological traces (Reg. item no. 5554)
	Neznašov	Elevated fortified settlement - fort, archaeological traces (Reg. item no. 5596)
	Neznašov	Ore mine - gallery only (Registry item no. 6018)
	Bohunice	Barrow ground, archaeological traces (Reg. item no. 5543)

C.2.10. Transport infrastructure and other infrastructure

C.2.10.1. Transport infrastructure

C.2.10.1.1. Road transport

The road transport infrastructure backbone in the area studied is A-road no. II/105 in the segment between České Budějovice and Týn nad Vltavou. This road passes by the power plant area in the southeastern direction, and the plant is connected to it by a side road. A car park with approximately 428 vehicles capacity including a bus station has been built in front of the plant. Among other important roads is A-road no. II/138, which connects to A-road no. II/105 south of the plant and passes along its southwestern side towards the village of Temelín and continues to Písek to connect to A-road no. II/121 to Milevsko. The nearest road infrastructure also includes road no. II/141 in the Vodňany - Týn nad Vltavou segment, connected to A-road no. II/105 by an access road northeast of the plant.

An internal road network has been built on the power plant premises making for access to the various buildings.

In the broader surroundings, the following roads will be affected by the NNPP construction:

- Road no. II/105 (Prague) - Jesenice - Jílové u Prahy - Neveklov - Sedlčany - Petrovice - Milevsko - Bernartice - Dražíč - Týn nad Vltavou - Hluboká nad Vltavou - (České Budějovice). This road is of major regional importance, particularly in the segment between Týn nad Vltavou and České Budějovice. This segment was modified to attain the homogeneous parameters of the S 11.5/70 width category within the construction of NPP Temelín (1986-1987) and thus it is virtually free from traffic shortcomings.
- Road no. II/137, (Načeradec - Mladá Vožice) - Tábor - Malšice - Sudoměřice u Bechyně - Hodětín, is of regional traffic importance. The road itself, in the segment south of Tábor, possesses parameters that basically match its current traffic importance. However, the parameters are poor in the segments where the road passes through some towns or villages; especially through Malšice. It is planned that the road should be improved to attain S 9.5/70 width category parameters in the future.
- Road no. II/138, Zvíkovské Podhradí - Oslov - Záhoří - Jehnědno - Albrechtice nad Vltavou - Všeteč - Temelín - II/105 junction at Býšov, is the only road of a class higher than Class III in the broad area of the Orlík dam passing in its longitudinal direction. In the Albrechtice nad Vltavou - Temelín segment, the road has been broadened to 5.3 m, with a new bituminous cover in the segment belonging to the Písek district and with a surface free from any apparent defects in the segment belonging to the České Budějovice district. In the Temelín junction II/105 (at Býšov) segment, the road has been broadened to 7.5 m, its surface is free from apparent defects. Modification to the homogeneous parameters of the S 7.5/50 width category is planned for the future.
- Road no. II/141, (Týn nad Vltavou) - Temelín - Číčenice - Vodňany - Bavorov - Prachatice - Libínské Sedlo - Volary, detaches from road no. II/105 at the at the “U Bulků” junction south of Týn nad Vltavou. The road is of supraregional importance, especially south of Vodňany (mainly, in combination with roads no. I/20 and I/4 or R4, to interconnect the Prachatice section of the Šumava and the mainland of Bohemia). It is 6 m wide and basically free from traffic defects. In the area of the town of Týn nad Vltavou it is territorially stabilised (this is also true of the approved territorial plan of the village of Temelín). Improvement to attain the homogeneous parameters of the S 9.5/70 width category is planned.
- Road no. II/147, Týn nad Vltavou - Žimutice - Dolní Bukovsko - Sviny - Veselí nad Lužnicí - Drahov - Kardašova Řečice, is of regional traffic importance in the Týn nad Vltavou - Dolní Bukovsko segment. Its parameters are at the general level of B-roads in the South-Bohemian region, i.e. road width approximately 6.5 m (mostly without hard shoulders) and a reasonably low number of defects, largely of point nature.

- Road no. II/159, Písek - junction I/20 Nový Dvůr - Tálín - Albrechtice nad Vltavou - Týn nad Vltavou - Dráchov - junction I/3 "U sloupu", until recently denoted no. I/23. Its traffic importance is hardly supraregional (the construction of NPP Temelín contributed little to its importance). Its parameters match its current traffic importance, except for segments where the road passes towns or villages plus a few segments with road defects.

The layout below shows the road network geometry including an overview of the census segments, and is completed with a table of the traffic volume and a cartogram of the traffic load of the road network near NPP Temelín (nationwide traffic census organised by the Directorate of Roads and Highways of the Czech Republic [ŘSD ČR], 2005).

Figure C.2.93: Road network in the wide area, with the road numbering and census profile numbers

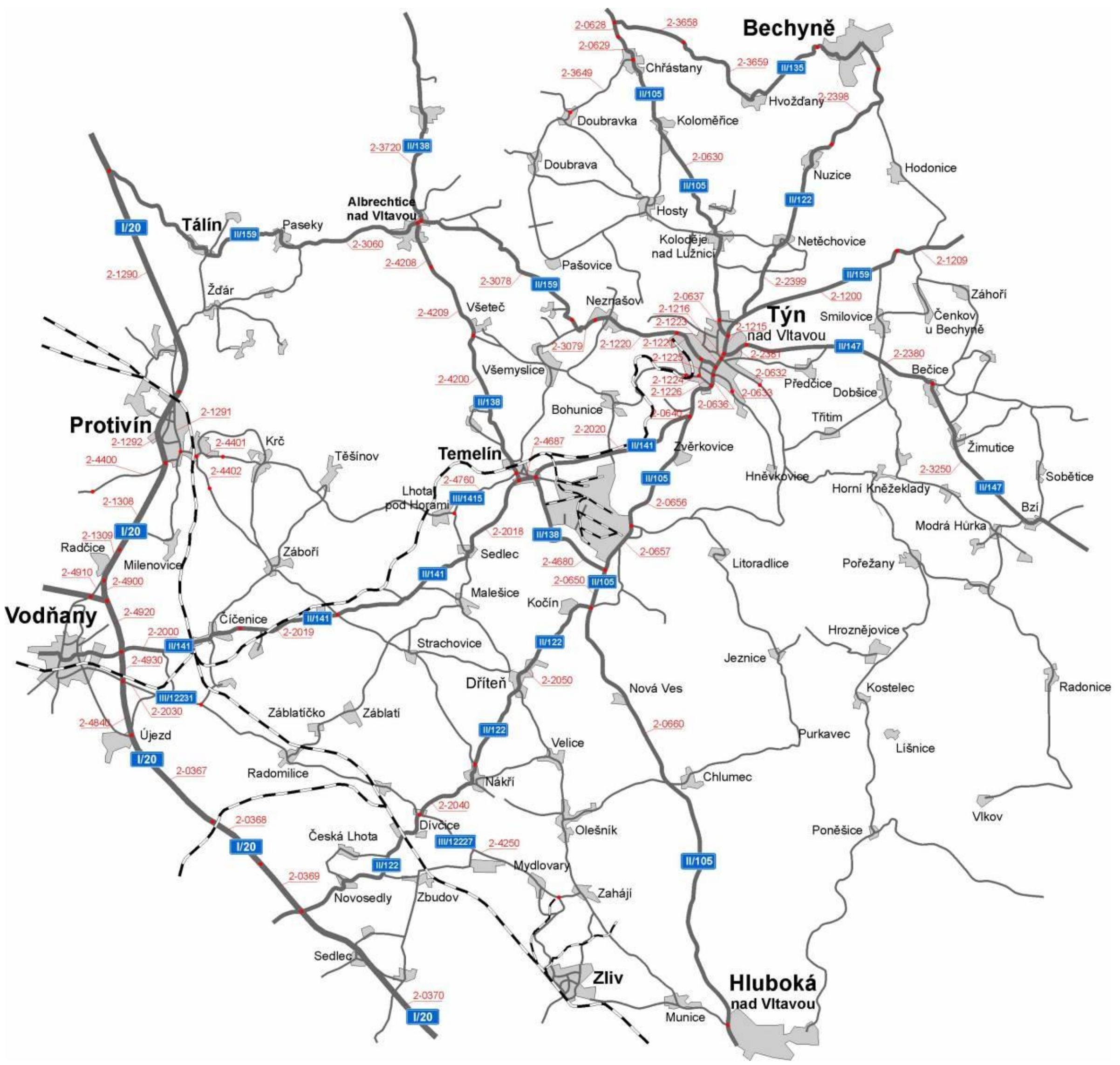


Table C.2.53: Annual average of daily traffic volumes [vehicles/24 hr] on the road network in the broader affected area (ŘSD ČR counts, 2005)

Profile	Road	Trucks	Cars	Motorcycles	Total
2-0367	I/20	2,744	7,406	33	10,183
2-0368	I/20	2,744	7,406	33	10,183
2-0369	I/20	2,744	7,406	33	10,183
2-0370	I/20	2,744	7,406	33	10,183
2-0628	II/105	188	652	10	850
2-0629	II/105	188	652	10	850
2-0630	II/105	326	1,851	30	2,207
2-0632	III/1472	224	1,036	24	1,284
2-0633	II/235	206	908	16	1,130
2-0636	II/105	1,497	5,325	44	6,866
2-0637	II/105	685	3,798	58	4,541
2-0640	II/105	1,280	5,120	45	6,445
2-0650	II/105	1,061	4,305	52	5,418
2-0656	II/105	1,359	3,767	23	5,149
2-0657	II/105	1,359	3,767	23	5,149
2-0660	II/105	1,061	4,305	52	5,418
2-1200	II/159	416	1,488	21	1,925
2-1209	II/159	416	1,488	21	1,925
2-1215	II/159	1,328	5,797	93	7,218
2-1216	II/159	2,129	7,971	106	10,206
2-1220	II/159	519	1,757	71	2,347
2-1221	II/159	519	1,757	71	2,347
2-1223	II/159	3,312	10,325	172	13,809
2-1224	III/12219	335	749	11	1,095
2-1225	III/12219	360	1,097	37	1,494
2-1226	III/12219	512	1,550	45	2,107
2-1290	I/20	2,649	6,662	36	9,347
2-1291	I/1404	261	1,483	19	1,763
2-1292	I/20	2,538	7,065	36	9,639
2-1308	I/20	2,538	7,065	36	9,639
2-1309	I/20	2,538	7,065	36	9,639
2-2000	II/141	388	1,288	23	1,699
2-2018	II/141	445	897	25	1,367
2-2019	II/141	445	897	25	1,367
2-2020	II/141	421	983	14	1,418
2-2030	III/12231	43	301	7	351
2-2040	II/122	205	492	13	710
2-2050	II/122	577	1,019	27	1,623
2-2380	II/147	454	1,415	25	1,894
2-2381	II/147	454	1,415	25	1,894
2-2398	II/122	330	1,570	14	1,914
2-2399	II/122	577	1,019	27	1,623
2-3060	II/159	359	1,344	34	1,737
2-3078	II/159	316	1,079	73	1,468
2-3079	II/159	316	1,079	73	1,468
2-3250	II/147	693	1,237	20	1,950
2-3649	III/10562	38	140	4	182
2-3658	II/135	73	527	11	611
2-3659	II/135	73	527	11	611
2-3720	II/138	130	341	9	480
2-4200	II/138	81	265	4	350
2-4208	II/138	130	341	9	480
2-4209	II/138	130	341	9	480
2-4250	III/12227	231	441	9	681
2-4400	III/02032	167	190	6	363
2-4401	I/1415	275	1,325	24	1,624
2-4402	III/14110	43	165	6	214
2-4680	II/138	346	359	4	709
2-4687	II/138	226	357	5	588
2-4760	I/1415	186	514	10	710
2-4840	III/14611	244	855	14	1,113
2-4900	I/20	2,538	7,065	36	9,639
2-4910	I/20	2,980	7,447	38	10,465
2-4920	I/20	3,203	8,980	44	12,227
2-4930	I/20	2,766	7,601	40	10,407

Figure C.2.94: Cartogram of the traffic load of the road network in the broader affected area

LEGENDA	LEGEND
2000 vozidel (1 mm = 1000 vozidel)	2,000 vehicles (1 mm = 1,000 vehicles)

Procedures in case of emergency and population evacuation from the emergency planning zone are described in detail in the document External Emergency Plan for the Temelín Nuclear Power Plant. Relevant in the present context is the section entitled “Plans of specific activities”.

In the event of emergency requiring evacuation of the population (Score 3 event pursuant to Decree no. 318/2002), entrance to the 13km emergency planning zone will be closed for the evacuation traffic to be undisturbed by traffic in the opposite direction. The closing of the zone is the responsibility of the Czech Republic Police (through checkpoints on the boundary of the 13km zone) and of the South-Bohemian Road Management and Maintenance company (through traffic closures and rerouting to avoid interferences with the evacuation stream). The evacuation routes specified by the NPP Temelín External Emergency Plan are as follows:

- Road no. II/105, direction: Týn nad Vltavou - Hluboká nad Vltavou - České Budějovice.
- Roads no. II/105, II/141, direction: Temelín - Hluboká nad Vltavou - České Budějovice.
- Road no. II/147, I/3, direction: Týn nad Vltavou - Dolní Bukovsko - Sviny - Horusice - České Budějovice.
- Roads no. II/105, II/122, direction:. Týn nad Vltavou - Nuzice - letiště Bechyně - Sudoměřice u Bechyně - Tábor.
- Roads no. II/105, I/29, direction: Týn nad Vltavou - Dražíč - Svatkovice - Borovany - Bernartice - Písek.

- Road no. II/159, direction:. Týn nad Vltavou - Albrechtice nad Vltavou - Tálín - Žďár - Myšenec - Skály - Strakonice.

The evacuation routes were selected taking into account the numbers of persons to be evacuated, mutual positions of the towns/villages and their parts, traffic capacities of the roads and siting of the decontamination points. The evacuation routes and procedures for the population in the emergency planning zone, and for NPP Temelín employees, are coordinated. All evacuation lines are routed by a decontamination point. Motorised patrols of the Czech Police will be present on all evacuation routes. Tasks for the patrols after announcement of evacuation shall be specified by the officer in command of the action, and the transmission to the patrols will be the appropriate commanding officers' responsibility. The evacuation routes and general tasks of the motorised patrols are described in detail in the evacuation plan variants and in the patrols' operative cards.

The following provisions will be implemented at the evacuation routes:

- Regulation of the motion of vehicles and persons (National Police, Municipal Police)
- Removal of the consequences of traffic accidents and restoration of traffic on the evacuation routes (corps of the Integrated Rescue System and the Czech Army)
- Establishment of temporary dosimetric control points at the main evacuation routes (fire brigades and the Czech Army).

The capacity of the evacuation routes is supported by the fact that traffic will be permitted in the evacuation direction only and will be regulated by National Police. The traffic performance of the routes is checked by daily traffic occurring on the roads.

C.2.10.1.2. Rail transport

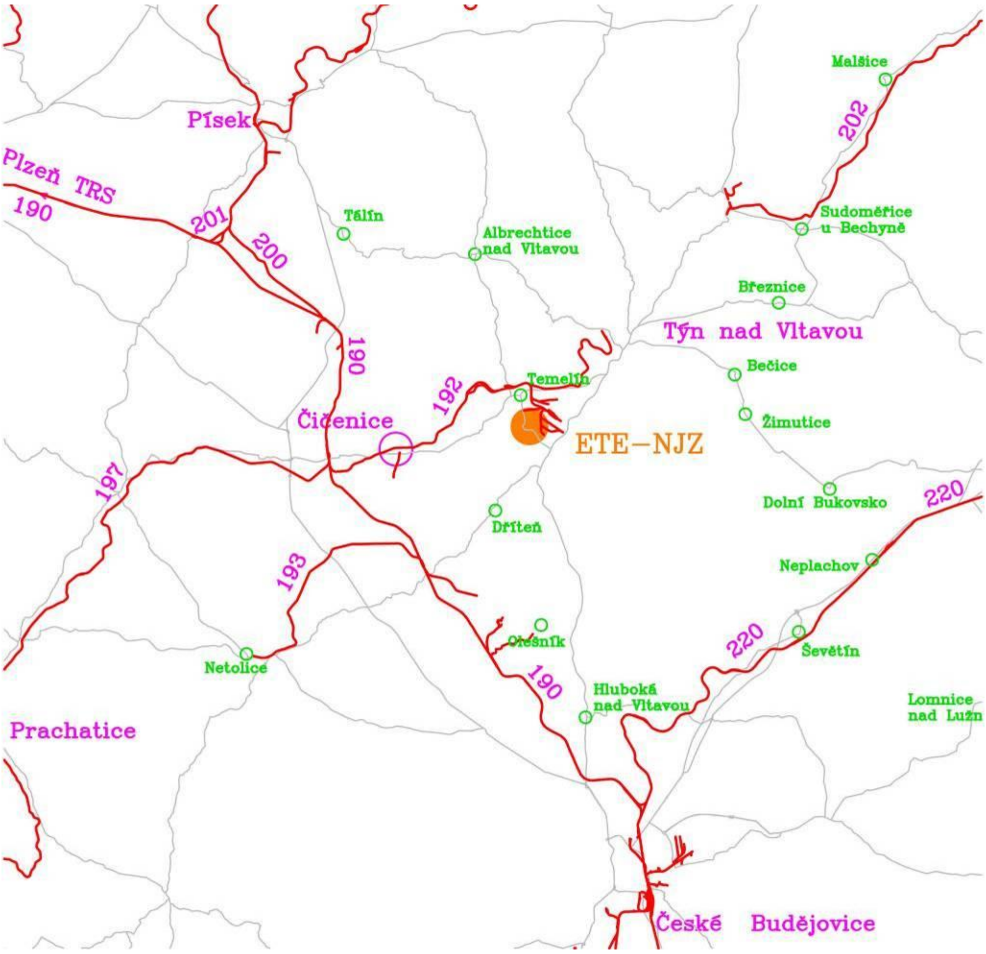
The power plant area is connected to the railway network through a siding from the Temelín railway station.

The Temelín railway station lies on track 192, Číčenice - Týn nad Vltavou. This single-track line of regional importance is operated by motor traction. It was built in 1898 and its Číčenice - Temelín segment was reconstructed within the NPP Temelín construction project in the 1980s. The track is 21.3 km long, the Číčenice - Temelín segment is 12.7 km long. The Číčenice - Temelín and Temelín - Týn nad Vltavou segments were upgraded to withstand axle loads of 22.5 t and 16 t, respectively. The maximum train length is 430 m (86 axles) (175 m, or 35 axles, in the Temelín - Týn nad Vltavou segment). The track velocity is 60 km/hr, usable on 75% of the total track length, the average track velocity is 56.9 km/hr. Passenger transport is provided (during workdays) by 7 pairs of passenger trains daily in an (incomplete) 2-hour cycle. Freight transport is operated at a rate of 0.8 freight trains per day, the mean train length is 14.9 axles. The mean annual freight transport throughput is 0.995 million gross ton-kilometres (0.455 million net ton-kilometres). The track capacity (in the Číčenice - Temelín segment) is currently used to 63%, with a margin of approximately 15 trains per day.

The track branches off from track no. 190, České Budějovice - Plzeň, which is a track of nationwide importance. It is a single-track line with two-track segments operated in electric traction. Its capacity (in the limiting Číčenice - Protivín segment) is currently used to 71%, with a margin of approximately 11 trains per day.

A layout of the railway network in the wider NPP Temelín area is shown in the figure below:

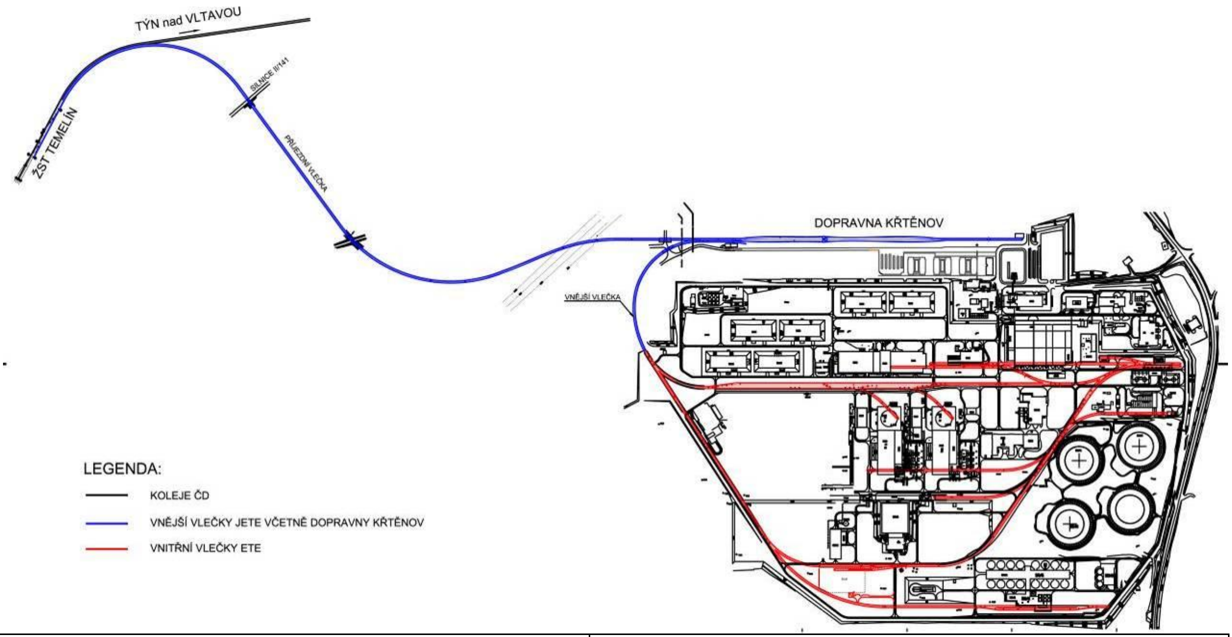
Figure C.2.95: Schematic map of the railway network in the broader affected area



The power plant area is connected to the railway network through a siding from the Temelín railway station. This siding is terminated at a transfer track point at the northeastern boundary of the plant premises. All rail transport for the power plant is implemented by means of this siding. A siding track - external siding - goes from the transfer point to the plant area, where (i) it is branched to the plant's handling rail yard and (ii) through a second branch, continues as siding track no. 4 to the southeastern and eastern parts of the area. The various tracks branch off from this siding to the plant buildings, and the track itself is connected to the gridiron of the handling track yard.

The connection of the plant to the railway network at the Temelín railway station will be clear from the track layout of the external and internal sidings.

Figure C.2.96: Layout of the external and internal NPP Temelín railway sidings



ŽST TEMELÍN	TEMELÍN RAILWAY STATION
DOPRAVNA KŘTĚNOV	KŘTĚNOV RAIL TRAFFIC CONTROL FACILITY (RTCF)
LEGENDA	LEGEND
KOLEJE ČD	ČD RAIL TRACKS
VNĚJŠÍ VLEČKY JETE VČETNĚ DOPRAVNY KŘTĚNOV	TNPP EXTERNAL SIDINGS INCLUDING KŘTĚNOV RTCF
VNITŘNÍ VLEČKY ETE	TPP INTERNAL SIDINGS

C.2.10.1.3. Air transport

The power plant site is a prohibited airspace (as defined in the Flight Information Manual). This prohibited airspace has the form of a cylinder 1,500 m high, 2 km radius. Military operation guidelines include a special traffic control provision for the Temelín Power Plant. No training or operating area exists above the plant site and the forbidden airspace is respected. Civil flight operations, general flight operations and military training air operations are practised in the wider surroundings without specific limitations, only governed by applicable air control regulations.

C.2.10.1.4. River traffic

The nearest river traffic on the Vltava is of seasonal recreational nature only.

C.2.10.1.5. Foot and bicycle traffic

There are numerous cycle routes and tourist tracks in the surroundings. The routes do not cross the power plant area or the new nuclear installation construction site.

C.2.10.2. Other infrastructure

All the requisite infrastructure at the project site has been built to satisfy the needs of a nuclear power plant with 4x1000 MWe reactor units. Hence, the infrastructure at the project site has a sufficient margin to cover additional needs.

C.2.11. Other environmental characteristics

No other environmental parameters are specified.

C.3. OVERALL EVALUATION OF THE ENVIRONMENTAL QUALITY IN THE AREA IN QUESTION IN RESPECT OF ITS TOLERABLE LOAD

It follows from the data presented in the preceding sections that the site planned for the new nuclear installation and its surroundings are of favourable environmental quality, complying with regulatory requirements and comparable to similar areas within the Czech Republic. Local deviations from this favourable situation may be due to local impacts (industrial plants and shops, traffic in the central parts of towns and villages, other activities in the local area).

The operation of the Temelín Power Plant itself is monitored and evaluated from both the radiological and non-radiological aspects. The results of the monitoring give evidence that the impacts of the plant operation on ambient environment are acceptable and comply with legislative requirements and regulatory limits and licensing conditions for operation.

As regards the radiation burden of the population, the plant's impacts lie within regulatory limits. Gaseous and liquid discharges in 2005-2008 are compared to applicable regulatory limits and expressed as their percent fractions in the table below:

Table C.3.1: Atmospheric emmissions and discharges into watercourses, 2005-2008, in comparison with, and as percentage fractions of applicable regulatory limits.

Year	Atmospheric discharges			Discharges into watercourses		
	Regulatory limit	Actual discharges		Regulatory limit	Actual discharges	
	[μSv]	[μSv]	[%]	[μSv]	[μSv]	[%]
2005	40	0.188	0.470	3	0.228	7.600
2006	40	0.053	0.133	3	0.396	13.20
2007	40	0.050	0.125	3	0.302	10.067
2008	40	0.030	0.075	3	0.584	19.467
Note: Regulatory limits for atmospheric discharges and discharges into watercourses are laid down by State Office for Nuclear Safety Decisions no. 28718/2007 of 29 October 2007 and 26161/2009 of 1 December 2009, respectively.						

Source: Výsledky monitorování výpustí a radiační situace v okolí jaderné elektrárny Temelín za roky 2005 - 2008. (Results of monitoring of discharges from the Temelín Power Plant and of the radiological situation in the plant's surroundings, 2005-2008). ČEZ, a.s., 2005, 2006, 2007, 2008.

The table demonstrates that radionuclides released into the environment with atmospheric discharges and discharges into watercourses are below the limits of committed effective doses to an individual from the population, laid down by applicable decisions of the authority responsible for governmental management and supervision of the use of nuclear energy and ionising radiation and of radiation protection (i.e. the State Office for Nuclear Safety).

PART D
COMPREHENSIVE DESCRIPTION AND ASSESSMENT OF THE PROJECT'S ENVIRONMENTAL AND HEALTH IMPACTS

D.I. DESCRIPTION OF EXPECTED PROJECT IMPACTS ON THE POPULATION AND THE ENVIRONMENT AND ASSESSMENT OF THEIR EXTENT AND SIGNIFICANCE

D.I.1. Impacts on the population, including socioeconomic impacts

D.I.1.1. Health impacts and hazards

2. PROJECT (UNITS 3+4)

The health impacts and risks have been assessed for the plant as a whole. Therefore, the summary information is included in the next section, dealing with the plant as a whole. However, if required, information regarding the project itself can be extracted from the information presented below.

PLANT (UNITS 1+2+3+4)

D.I.1.1.1. Methodology

The health impacts have been assessed by using the Risk Assessment approach, which is based on procedures developed and constantly improved by the US Environmental Protection Agency (EPA) and by the European Union. Those procedures also form the basis of the directives of the Czech Ministry of the Environment. The procedures are aimed at identifying the nature and probability of occurrence of potential adverse effects that may affect humans and the environment due to exposure to chemicals and other pollutants.

The conventional risk assessment procedure consists of 4 consecutive steps:

a) Hazard identification

During this step, qualitative insight is gained into the site, pollutants and factors contributing to their potential adverse impacts on the population. The outcome of this step includes a list of health-relevant pollutants, along with a justification of the method of their selection. The list is completed with a description of the basic physical, chemical and toxicological properties of the pollutants selected, their migration and any transformations in the environment, exposure pathways, effect(s) they exert in the human body and possible health impacts.

b) Dose-response assessment

The relation between the level of exposure and the magnitude of the risk is identified in this step. The hazard posed by a pollutant is frequently expressed in terms of the life-long risk arising from a unit exposure.

Chemical as well as physical pollutants are classed in the following 2 basic categories with respect to their health effects:

- Pollutants with a threshold of their effects, where very low doses up to a certain threshold are assumed to have no adverse effect. Above the threshold, the severity of the impact increases with increasing exposure. The majority of toxic substances fall in this category.

- Non-threshold pollutants, which are assumed to exert adverse effects starting from the lowest doses. The risk thus increases with exposure starting from a zero level. The dose-response relation is largely considered linear in the low dose region. The majority of carcinogenic substances, as well as ionising radiation, are classed in this category.

Some substances can exert effects of both types, i.e. threshold (toxic) effects as well as non-threshold (carcinogenic) effects. In such cases the assessment is usually based on the non-threshold effect, which is more severe than the threshold effect at the low pollutant levels typically encountered in the environment.

Different risk assessment approaches are applied to threshold pollutants and to non-threshold pollutants.

For threshold-effect pollutants, the threshold, referred to as NOAEL (No Observable Adverse Effect Level), is determined based on animal studies and epidemiological human studies. This threshold is a measure of the substance's toxicity. The lower the threshold, the more toxic the substance. A reference dose (RfD), which is typically 3 to 4 orders of magnitude lower (i.e. more stringent) than NOAEL, is then derived from the NOAEL by applying a safety factor and an uncertainty factor. The reference dose is defined as an estimate of the daily exposure of the human population (including sensitive subgroups) whose life-long effect probably does not cause any health detriment. For exposure by inhalation, the reference concentration (RfC) is defined analogously.

For non-threshold substances, an exposure level that is considered "acceptable" is determined based on scientific knowledge. This is referred to as the risk-specific dose (RsD). The analogous risk-specific concentration (RsC) is determined for exposure by inhalation. However, the decision as to what is "acceptable" is often controversial, being assessed differently by different countries and institutions. One case of health detriment in a million population (1.10^{-6}, or 1E-06) is the most stringent criterion. Less stringent levels, such as 1.10^{-4}, are sometimes admitted. The RsD (or RsC) level is derived from the intensity of the carcinogenic effect, i.e. from the slope of the dose-response curve. This intensity is characterised by the slope of the dose-response relation in the low-dose range (Slope Factor, Cancer Risk Unit). Since this quantity depends on the exposure pathway (way of entering the body), it is determined separately as the Oral Slope Factor (OSF) for oral intake (intake by the digestive tract) or as the Inhalation Unit Risk (IUR) for intake by inhalation.

The RfD, RfC, RsD and RsC levels are referred to as exposure limits. Their setting is a complex multidisciplinary scientific process in which competent institutions such as the US EPA and WHO are engaged. Assessments presented in this document are largely based on US EPA exposure limits. For low ionising radiation doses the procedure is basically the same, using factors developed by the International Commission on Radiological Protection (ICRP) as the criteria.

c) Exposure assessment

In this step, the levels (doses) at which the various groups of people (subpopulations) are exposed to chemicals or to other adverse factors from the environment are estimated. Exposure depends, as well as on the concentrations of the substance in the compartments of the environment, on the site of residence of the people and on their activities. For exposure by inhalation, it is relevant how much time the members of the various subpopulations (including risk subpopulations) spend outdoors and indoors and how vigorously they breathe outdoors (during work or sports). For oral exposures (by ingestion), relevant factors include, e.g. the amount of water drunk daily from the local source and the amount of contaminated foods eaten. The processing of the exposure data is an extremely complex task, the most difficult in the entire risk assessment chain. In practical EIA it is usually not evaluated for each project individually; instead, it is based on exposure models developed by the above-mentioned competent institutions.

d) Risk description

In this last step, the health impact on the population/subpopulations is predicted based on a combination of information regarding the hazard posed by each substance and of exposure data. For substances with a threshold, the exposure ratio (ER) is calculated. This is the ratio of exposure to the applicable exposure limit or recommended reference level. If $ER < 1$, the risk is negligible, whereas if not, the effect should be analysed in more detail. For non-threshold substances the risk per unit population is calculated. A risk in the order of 10^{-6} is the most stringent requirement. This means 1 disease/death in a million people on lifelong exposure.

In conclusion of this methodology section it is noteworthy that risk assessment by the above procedure is relevant where no limit exists for the given pollutant in the environmental compartment (air, water, ...) or where the limit is exceeded. The limits have been set so as to guarantee harmlessness with a sufficient margin. If the limits are complied with, the calculation by the procedure described above will usually only confirm this fact. Hence, risk assessment by the above calculations is usually not performed where the limits are complied with, unless specific reasons for performing such calculations exist.

D.I.1.1.2. Radiation effects

D.I.1.1.2.1. Ionising radiation and its biological effects

Ionising radiation is a manifestation of radioactivity, i.e. natural or artificially induced ability of some unstable atomic nuclei to undergo spontaneous transmutation, associated with the emission of (electromagnetic or corpuscular) radiation, thereby passing to an energetically lower and more stable state. If this process is associated with a change in the number of protons in the atomic nucleus, the chemical element changes.

The transmutation of radioactive atoms (radionuclides) is a process obeying a physical law. A transmutation pathway and a decay half-life are constant parameters for each radionuclide.

Radiation produced during radioactive decay is classed in 4 categories:

a) Alpha (α) radiation, which is a stream of helium nuclei (α-particles, composed of 2 protons and 2 neutrons) carrying a positive electric charge. Alpha radiation has the lowest penetrating ability, it can be stopped, e.g., with a sheet of paper.

b) Beta (β) radiation emerges from a process emitting either an electron (e^-) along with a neutrino or a positron (e^+) along with an antineutrino. Thus we discriminate between β^- radiation (electrons) and β^+ radiation (positively charged positrons). Although the penetrating ability of beta radiation is higher than that of alpha radiation, it is captured, e.g., by a layer of plexiglass 1 cm thick or by a layer of lead 1 mm thick.

c) Gamma (γ) radiation consists of high-frequency electromagnetic waves. Gamma radiation possesses a very high penetrating ability, so very thick shields made of high-density metals (such as lead) or alloys of such metals are used to shield off gamma radiation.

d) Neutron radiation is electrically neutral corpuscular radiation with an indirect ionising capacity. The penetrating ability of neutrons is also very high. Unlike gamma radiation, neutrons interact with atomic nuclei. This interaction gives rise both to secondary gamma radiation and to charged particles, which efficiently ionise atoms of the medium they are passing through.

Any interaction of (directly or indirectly) ionising radiation with matter disturbs the stability of the atoms and molecules, bringing about formation of unstable ions. In live cells, ionising radiation produces ions and free radicals, thereby disturbing chemical bonds and damaging the cells. The effect of radiation depends on the energy, mass and charge of the particles/photons. Gamma radiation has a “thin” ionising effect - along with X-rays, gamma radiation is referred to as “low-LET radiation”. On the contrary, charged corpuscular radiation exerts a dense ionising effect.

Radiation sources to which humans are exposed are classed either as natural sources or as artificial (man-made) sources. Radiation from natural sources exists in the environment to various degrees. Such radiation comes from 3 major sources: (a) cosmic radiation; (b) radium, thorium, uranium and other radioactive elements in the Earth's crust (terrestrial radiation); and (c) internal irradiation from radionuclides contained in live cells (^{40}K potassium isotope, ^{14}C carbon isotope). Radon in buildings, which is also of terrestrial origin, contributes as well.

Summary data of dose distributions among Czech population are included in Section C.2.3.3, Ionising radiation (this document, page 262).

Adverse effects of ionising radiation on humans can be categorised in 2 classes:

a) Deterministic effects bringing about tissue damage (such as skin inflammation, cataract, acute radiation sickness). Such effects occur in response to high-dose exposures. A threshold exists above which the severity of the damage and weakening of the recovering capacity increase with increasing dose whereas no effect occurs below the threshold. Frequently, but not always, the effects are acute, occurring early after exposure.

b) Stochastic effects, typically inducing malignant tumours and hereditary damage. Stochastic effects may occur not only in response to high doses but also in response to low doses. In the conservative approach, which is generally accepted and used in the radiation protection domain, stochastic effects are considered non-threshold, the response increasing linearly with increasing dose. In this case, a higher dose brings about a higher probability of damage rather than a higher severity of damage. In contrast to carcinogenic effects, adverse hereditary effects in humans have not been proven. Stochastic effects are late effects, manifesting themselves in a certain period of time, often in many years.

D.I.1.1.2.2. Nature of the dose-response relation

As regards assessment of the potential impacts of the Temelín Power Plant on the population, it is reasonable to assess stochastic effects only, in view of the very low radiation doses present.

Scientific knowledge, from which the risks to humans posed by exposure to ionising radiation are derived, is based on human studies (including particularly studies of survivors of the nuclear weapon explosions in Hiroshima and Nagasaki and their progeny and other specific epidemiological studies) and experimental animal studies (on mice in particular). A fatal malignant tumour risk factor for the population at a level of $5x10^{-2}$ Sv^{-1} has been derived from the Hiroshima and Nagasaki studies. This level means that a dose of 1 Sv is expected to bring about 5 deaths among 100 individuals, and a dose of 1 mSv is expected to cause 5 deaths in a population of 100,000.

Although remaining a scientifically acceptable concept for the radiation protection practice, the above linear non-threshold model of stochastic effects of low radiation doses cannot be unambiguously proven. In view of that uncertainly. the ICRP[1] in its recent report (2007) does not consider it appropriate for public health planning purposes to enumerate any hypothetical numbers of tumours that may be caused by very low radiation doses to large populations over a very long period of time.

Based on state-of-the-art scientific knowledge, the ICRP has developed numerical factors for estimating the health detriment [2], which are presented in the table below. The factors take into account the potential risk of fatal and non-fatal malignant tumours, damage to progeny and life-shortening effect. Hereditary damage, i.e. damage transmitted to the individuals' children, is also included although this phenomenon has not been proven in humans. This is a precaution made in view of the fact that convincing evidence in this respect exists in animals, as provided by experimental studies. The first row in the table refers to the whole population, the second row refers to radiology staff. In the present document, the risk of detriment to the population has been calculated by using the factor of $0.057.Sv^{-1}$.

Table D.I.1: Nominal risk factors of detriment for stochastic effects arising from exposure to low radiation doses [10^{-2} Sv^{-1}]

Exposed population	Tumours	Hereditary effects	Total
Total	5.5	0.2	5.7
Adult staff	4.1	0.1	4.2

Findings regarding stochastic effects of ionising radiation on humans also serve as the basis for deriving the routinely used limiting levels. The non-threshold model implies that no levels at which radiation is absolutely harmless can be set: even minimal doses induce biological effects (although minimal as well).

[1] Established in 1928, the ICRP (International Commission on Radiological Protection) is an independent non-governmental organisation, which processes new scientific findings in radiology on an ongoing basis and uses them to update preventive measures for protection against the risks associated with (both artificially produced and natural) ionising radiations. ICRP interconnects renowned radiology experts worldwide and thus enjoys high international prestige. All international standards and national regulatory activities in radiological protection are based on ICRP recommendations.

[2] Detriment in the ICRP concept is the total harm suffered by the exposed group and their progeny as a consequence of exposure to a radiation source. This is a multidimensional concept. Its basic components include the following stochastic quantities: probability of inducing a fatal tumour; weighted probability of inducing a curable tumour; weighted probability of inducing severe hereditary consequences and life shortening due to damage.

The acceptable risk concept is adopted here as a recourse. This means that a probability of effects that is acceptable from the health and social aspects should be ensured. The criteria are very stringent of course.

One of the main radiological protection principles requires that all exposures be maintained as low as reasonably achievable, taking into account financial and social aspects (optimisation principle). Hence, efforts are made to hold the levels of human irradiation at the lowest possible yet reasonably achievable level.

Special attention is paid to "critical subpopulations" when assessing the effects of radiation on the population and performing inspections aimed at compliance with specified limits. Act no. 18/1997 Coll. on peaceful uses of nuclear energy and ionising radiation (Atomic Act) (as amended) defines a critical subpopulation as a "model group of natural persons which represents those individuals in the population who are most irradiated from a given source and by a given pathway". In this case they are the "representative persons".

Section 19 of Decree no. 307/2002 on radiation protection (as amended) lays down (in accordance with the ICRP Recommendation) a general limit of 1 mSv in a calendar year for the sum of effective doses from external irradiation and committed effective doses from internal irradiation from man-made sources. This limit applies to the critical calculated irradiation in a critical subpopulation encompassing all irradiation pathways and all ionising radiation sources.

In addition, authorised limits as mandatory quantitative indicators (ibid., Section 18) are imposed (through licences issued by the Czech State Office for Nuclear Safety) for a single radiological activity and/or for a single ionising radiation source, usually as an outcome of radiological protection optimisation.

The above decree (Section 56 paragraph 3) lays down an average effective dose of 250 μSv in a calendar year as the optimisation limit for total radioactive discharges with respect to the critical subpopulation at a nuclear power installation, in this 200 μSv for atmospheric discharges and 50 μSv for discharges into watercourses. The State Office for Nuclear Safety has the authority to set more stringent limits[1].

D.I.1.1.2.3. Exposure of the population

Six basic exposure pathways are considered with respect to the exposure of population of any age:

a) by inhalation of air contaminated by radionuclides,
b) by eating food which has been grown at the site and may contain radionuclides,
c) by external irradiation from a "cloud", i.e. from contaminated air,
d) by external irradiation from ground deposits,
e) by inhalation of radionuclides resuspended from the deposit,
f) by using contaminated water.

Effective dose and committed effective dose data serving as the basis for the health risk assessment are given in Section D.I.3.3,Effects of ionising radiation (this document, page 407). It follows from the data that:

a) The radiation burden to the population decreases with increasing distance from NPP Temelín, rather steeply first and mildly at larger distances,

b) The total radiation burden is contributed to most by the effective doses from a "cloud", committed effective doses from ingestion, and committed effective doses from inhalation while committed effective doses from the inhalation of resuspended radionuclides play a minor, actually negligible role,

c) Yearly radioactivity intake by the population in the actual situation of known atmospheric discharges from the existing NPP Temelín units is roughly 1 order of magnitude lower than the intake calculated based on the design assumptions,

d) Doses from the deposit increase slightly during the first 30 years of operation and change only little in the subsequent period.

[1] The following authorised limits for the release of radionuclides from an existing power plant have been set:

- 3 μSv/year from discharges into watercourses (State Office for Nuclear Safety Decision no. 26161/2009 of 1 December 2009),
- 40 μSv/year from atmospheric discharges (State Office for Nuclear Safety Decision no. 28718/2007 of 29 October 2007)

D.I.1.1.2.4. Risk description

Risk from atmospheric discharges

The effective doses and committed effective doses received by a representative individual from atmospheric discharges are given in Section D.I.3.3,Effects of ionising radiation (this document, page 407).

When using the conservative assumption of 70 years of exposure of the whole population during their life, then the cumulated life-long burdens are 70-fold multiples of the sums reported in that section. Those multiples for the time horizons considered are included in the tables below.

Table D.I.2: Total sums of the effective doses and committed effective doses [Sv] received by the population over 70 years, data as of 2020

Distance [m]	New installation		Current operation	
	2x1200 MW_e	2x1700 MW_e	Design	Measurement
667	1.33E-04	3.02E-04	5.47E-04	2.70E-05
1,333	5.29E-05	9.59E-05	1.67E-04	1.57E-05
2,333	3.49E-05	6.00E-05	1.04E-04	1.17E-05
3,333	2.30E-05	3.70E-05	6.34E-05	8.26E-06
4,333	1.76E-05	2.60E-05	4.40E-05	6.38E-06
5,333	1.30E-05	1.96E-05	3.30E-05	5.19E-06
6,333	1.09E-05	1.57E-05	2.61E-05	4.45E-06
7,333	9.24E-06	1.30E-05	2.15E-05	3.91E-06
8,667	7.77E-06	1.06E-05	1.72E-05	3.40E-06
10,667	6.83E-06	8.26E-06	1.32E-05	2.86E-06
12,667	5.20E-06	6.66E-06	1.06E-05	2.46E-06
14,667	4.88E-06	5.61E-06	8.75E-06	2.17E-06
17,333	4.23E-06	4.60E-06	7.07E-06	1.87E-06
21,667	3.88E-06	4.19E-06	6.27E-06	1.95E-06
26,667	2.42E-06	2.73E-06	4.06E-06	1.23E-06
33,333	1.94E-06	2.15E-06	3.12E-06	1.03E-06
43,333	3.61E-06	3.84E-06	5.21E-06	2.04E-06
53,333	2.73E-06	2.88E-06	3.86E-06	1.57E-06
66,667	2.04E-06	2.12E-06	2.81E-06	1.18E-06
86,667	1.46E-06	1.50E-06	1.97E-06	8.61E-07

Table D.I.3: Total sums of the effective doses and committed effective doses [Sv] received by the population over 70 years, data as of 2050

Distance [m]	New installation		Current operation	
	2x1200 MW_e	2x1700 MW_e	Design	Measurement
667	1.48E-04	3.02E-04	5.47E-04	2.70E-05
1,333	6.04E-05	9.66E-05	1.67E-04	1.57E-05
2,333	4.00E-05	6.01E-05	1.04E-04	1.17E-05
3,333	2.67E-05	3.70E-05	6.34E-05	8.26E-06
4,333	2.12E-05	2.60E-05	4.40E-05	6.38E-06
5,333	1.48E-05	1.97E-05	3.30E-05	5.19E-06
6,333	1.25E-05	1.58E-05	2.61E-05	4.45E-06
7,333	1.06E-05	1.31E-05	2.15E-05	3.91E-06
8,667	8.96E-06	1.06E-05	1.72E-05	3.40E-06
10,667	8.40E-06	8.26E-06	1.32E-05	2.86E-06
12,667	5.92E-06	6.68E-06	1.06E-05	2.46E-06
14,667	5.99E-06	5.63E-06	8.75E-06	2.17E-06
17,333	5.40E-06	4.62E-06	7.07E-06	1.87E-06
21,667	4.71E-06	4.20E-06	6.27E-06	1.95E-06
26,667	2.87E-06	2.74E-06	4.06E-06	1.23E-06
33,333	2.32E-06	2.16E-06	3.13E-06	1.03E-06
43,333	4.21E-06	3.85E-06	5.21E-06	2.04E-06
53,333	3.14E-06	2.88E-06	3.86E-06	1.57E-06
66,667	2.30E-06	2.13E-06	2.81E-06	1.18E-06
86,667	1.65E-06	1.50E-06	1.97E-06	8.61E-07

Table D.I.4: Total sums of the effective doses and committed effective doses [Sv] received by the population over 70 years, data as of 2080

Distance [m]	New installation	
	2x1200 MW_e	2x1700 MW_e
667	1.48E-04	3.02E-04
1,333	6.08E-05	9.66E-05
2,333	4.03E-05	6.01E-05
3,333	2.68E-05	3.70E-05
4,333	2.14E-05	2.60E-05
5,333	1.49E-05	1.97E-05
6,333	1.26E-05	1.58E-05
7,333	1.06E-05	1.31E-05
8,667	9.03E-06	1.06E-05
10,667	8.47E-06	8.26E-06
12,667	5.94E-06	6.68E-06
14,667	6.03E-06	5.64E-06
17,333	5.45E-06	4.62E-06
21,667	4.75E-06	4.21E-06
26,667	2.89E-06	2.74E-06
33,333	2.33E-06	2.16E-06
43,333	4.23E-06	3.85E-06
53,333	3.16E-06	2.88E-06
66,667	2.32E-06	2.13E-06
86,667	1.66E-06	1.50E-06

The risk assessment exercise is methodologically based on the above-mentioned ICRP Report 2007. The Report recommends assessing the health detriment risk by using newly determined coefficients. In accordance with the recommendation, the total sums of the committed effective doses from inhalation and ingestion and of the effective doses from external irradiation over 70 years have been multiplied by a factor of 0.057 Sv^{-1}. In this manner the risk (i.e. probability) of health detriment was obtained, as presented in the tables below.

Table D.I.5: Life-long risk of health detriment [-] from atmospheric discharges, data as of 2020

Distance [m]	New installation		Current operation	
	2x1200 MW_e	2x1700 MW_e	Design	Measurement
667	7.58E-06	1.72E-05	3.12E-05	1.54E-06
1,333	3.02E-06	5.47E-06	9.54E-06	8.94E-07
2,333	1.99E-06	3.42E-06	5.95E-06	6.66E-07
3,333	1.31E-06	2.11E-06	3.61E-06	4.71E-07
4,333	1.01E-06	1.48E-06	2.51E-06	3.63E-07
5,333	7.38E-07	1.12E-06	1.88E-06	2.96E-07
6,333	6.18E-07	8.94E-07	1.49E-06	2.53E-07
7,333	5.27E-07	7.42E-07	1.22E-06	2.23E-07
8,667	4.43E-07	6.02E-07	9.82E-07	1.94E-07
10,667	3.89E-07	4.71E-07	7.54E-07	1.63E-07
12,667	2.96E-07	3.80E-07	6.02E-07	1.40E-07
14,667	2.78E-07	3.20E-07	4.99E-07	1.24E-07
17,333	2.41E-07	2.62E-07	4.03E-07	1.07E-07
21,667	2.21E-07	2.39E-07	3.58E-07	1.11E-07
26,667	1.38E-07	1.56E-07	2.31E-07	7.02E-08
33,333	1.11E-07	1.22E-07	1.78E-07	5.87E-08
43,333	2.06E-07	2.19E-07	2.97E-07	1.16E-07
53,333	1.56E-07	1.64E-07	2.20E-07	8.94E-08
66,667	1.16E-07	1.21E-07	1.60E-07	6.74E-08
86,667	8.34E-08	8.54E-08	1.13E-07	4.91E-08

It is clear from the table that the risk is minimal. The first distance (667 m) need not be taken into account from this point of view: there is no inhabited area at that distance, and the data are only given for the sake of completeness. When applying a very conservative approach, the highest possible life-long risk on the nearest inhabited area (i.e. at a distance of 1,333 m) is in the order of 10^{-6} for all the sources assessed based on the design data. This complies with the most stringent internationally recognised criteria. The risk decreases rather fast with increasing distance to drop to levels as low as 10^{-7} and, at larger distances, even 10^{-8}. This is especially true of the results obtained based on actual measurements of the existing discharges.

The critical subpopulation covers (in accordance with the SÚJB decision regarding atmospheric discharges from the existing plant) inhabitants residing at distances up to 5 km from the centre of the nuclear power plant. The whole town of Týn nad Vltavou is included in the area although only a part of the town lies within the 5 km zone. The critical subpopulation defined encompasses approximately 12,000 individuals. Residence areas within the critical subpopulation area occupy a zone at a distance of roughly 1,333 m to 5,333 m from the plant. The health detriment risk in the critical subpopulation is from 3.02E-06 to 7.38E-07 for the 2x1200 MW_e power alternative, 5.47E-06 to 1.13E-06 for the 2x1700 MW_e power alternative, from 9.58E-06 to 1.88E-06 for the existing 2 reactor units based on the design data, and from 8.94E-07 to 2.96E-07 for the same 2 units based on the actual gaseous discharge data. Hence, the risks to the critical subpopulation are minimal and fully comply with stringent internationally recognised requirements.

It is clear from the large differences between the risks estimated for the NNPP, and risks derived from the discharge measurements at the existing NPP Temelín units, that the addition of risk from the existing reactor units to the risk of any of the NNPP or NPP Temelín power alternatives, will not significantly affect the total risk level in the residence area. For instance, in the power alternatives of 2x1200 MW_e and 2x1700 MW_e, the risk at a distance of 1,333 m will increase from 3.02E-06 to 3.91E-6 and from 5.47E-06 to 6.36E-06, respectively.

A comparison of the risks from the existing operation deserves particular attention. Based on the design, a risk of 9.58E-06 could be expected at a distance of 1,333 m in 2020, whereas calculations based on actual atmospheric discharge measurements give a risk level of 8.94E-07, hence one order of magnitude lower. This demonstrates that the conservative design-based atmospheric discharge data are highly overestimated. The reality is considerably more favourable than the design assumptions.

The risks calculated analogously for additional time horizons are presented in the tables below.

Table D.I.6: Life-long risk of health detriment [-] from atmospheric discharges, data as of 2050

Distance [m]	New installation		Current operation	
	2x1200 MW_e	2x1700 MW_e	Design	Measurement
667	8.42E-06	1.72E-05	3.12E-05	1.54E-06
1,333	3.44E-06	5.51E-06	9.54E-06	8.94E-07
2,333	2.28E-06	3.42E-06	5.95E-06	6.66E-07
3,333	1.52E-06	2.11E-06	3.61E-06	4.71E-07
4,333	1.21E-06	1.48E-06	2.51E-06	3.63E-07
5,333	8.46E-07	1.12E-06	1.88E-06	2.96E-07
6,333	7.14E-07	8.98E-07	1.49E-06	2.53E-07
7,333	6.02E-07	7.46E-07	1.22E-06	2.23E-07
8,667	5.11E-07	6.06E-07	9.82E-07	1.94E-07
10,667	4.79E-07	4.71E-07	7.54E-07	1.63E-07
12,667	3.37E-07	3.81E-07	6.02E-07	1.40E-07
14,667	3.41E-07	3.21E-07	4.99E-07	1.24E-07
17,333	3.08E-07	2.63E-07	4.03E-07	1.07E-07
21,667	2.69E-07	2.39E-07	3.58E-07	1.11E-07
26,667	1.64E-07	1.56E-07	2.31E-07	7.02E-08
33,333	1.32E-07	1.23E-07	1.78E-07	5.87E-08
43,333	2.40E-07	2.19E-07	2.97E-07	1.16E-07
53,333	1.79E-07	1.64E-07	2.20E-07	8.94E-08
66,667	1.31E-07	1.21E-07	1.60E-07	6.74E-08
86,667	9.42E-08	8.54E-08	1.13E-07	4.91E-08

Table D.I.7: Life-long risk of health detriment [-] from atmospheric discharges, data as of 2080

Distance [m]	New installation	
	2x1200 MW_e	2x1700 MW_e
667	8.46E-06	1.72E-05
1,333	3.46E-06	5.51E-06
2,333	2.29E-06	3.43E-06
3,333	1.53E-06	2.11E-06
4,333	1.22E-06	1.48E-06
5,333	8.50E-07	1.12E-06
6,333	7.18E-07	8.98E-07
7,333	6.06E-07	7.46E-07
8,667	5.15E-07	6.06E-07
10,667	4.83E-07	4.71E-07
12,667	3.39E-07	3.81E-07
14,667	3.44E-07	3.21E-07
17,333	3.11E-07	2.63E-07
21,667	2.71E-07	2.40E-07
26,667	1.65E-07	1.56E-07
33,333	1.33E-07	1.23E-07
43,333	2.41E-07	2.19E-07
53,333	1.80E-07	1.64E-07
66,667	1.32E-07	1.21E-07
86,667	9.46E-08	8.54E-08

The data demonstrate that in comparison to 2020, the situation will not be changed appreciably due to the deposition of radionuclides in 2050. Although increasing slightly, the calculated risk levels in the inhabited area (from the 1,333 m zone inclusive) remain within the range of 10^{-7} to 10^{-6} and hence, fully comply as regards any health detriment. As to the difference between the data calculated from the design documents and from actual measurements of atmospheric discharges from the 2 existing reactor units, the conclusion made as of 2020 holds. Once again, the sum of the risk from any power alternative of the NNPP and the risk from the existing NPP Temelín unit operation does not increase the total impacts significantly. At a distance of 1,333 m, the risk increases from 3.45E-06 to 4.34E-06 and from 5.51E-06 to 6.40E-06 in the 2x1200 MW_e and 2x1700 MW_e power alternatives, respectively.

As far as the year 2080 is concerned, the radiological burdens and the risks derived from them have only been calculated for the new reactor units because the existing 2 reactor units won't be operated any further beyond 2050 and the expected shutdown process will not affect the deposit appreciably. Owing to this, the risks in 2080 are nearly identical with those in 2050. i.e. no harm.

In addition, the fact should be taken into account that the design documents as well as the procedures for their evaluation are based on conservative assumptions (i.e. they are rather overestimated), as demonstrated for the 2 existing NPP Temelín reactor units by comparing the levels based on the design data and on actual atmospheric discharge data. Thus it is very likely that the burden posed by atmospheric discharges from the new nuclear installation will be lower than as indicated by the above data. Now, in addition to this conservatism following from the design itself, the assessment scenario is highly conservative as well, including the approach to ingestion as it is assumed that what is grown in the area will also be consumed there.

In view of the fact that the radiation burden to children may be different from that to adults, whereby the overall health detriment estimates may be affected, the above-mentioned effective dose and committed effective dose calculations were also performed for the various age groups of children in accordance with Decree 307/2002, i.e. age 0-1, 1-2, 2-7, 7-12, 12-17. The results are included in Section D.I.3.3,Effects of ionising radiation (this document, page 407). It is clear from the tables in that section that the annual doses and committed effective doses are slightly higher in children than in adults, the differences, however, are small and apparently cannot alter the total result of life-long health risks appreciably. This is demonstrated by the following calculation.

In the preceding paragraph, the annual effective doses and committed effective doses for the population as a whole were summed up for 70 years of life. In the refined calculations including data for children, the age groups 0-1 and 1-2 will contribute 1 year to the life-long burden, the age groups 2-7, 7-12, and 12-17 will contribute 5 years each. The adult age contributes then to the difference, i.e. 53 years. The numbers of years are multiplied by the appropriate dose and dose commitment data for each age group, summed up to provide the life-long burden, and finally multiplied by the above-mentioned factor of 0.057 Sv^{-1} to calculate the health detriment risk. The results are summarised in the table below (to save space, only the surrounding zones in which the critical subpopulation is living are included, i.e. 1,333 m and 5,333 m).

Table D.I.8: Life-long sums of effective doses and committed effective doses [Sv] received by the population and the risk of health detriment [-] when taking into account data for children, and their comparison with the calculation results for adults

Source	Year	Distance	Accounting for child age		Adults	
			Dose [Sv]	Heath detriment [-]	Dose [Sv]	Heath detriment [-]
2x1200 MW_e	2020	1,333	5.56E-05	3.17E-06	5.29E-05	3.02E-06
		5,333	1.36E-05	7.76E-07	1.30E-05	7.38E-07
	2050	1,333	6.32E-05	3.60E-06	6.04E-05	3.44E-06
		5,333	1.55E-05	8.85E-07	1.48E-05	8.46E-07
	2080	1,333	6.35E-05	3.62E-06	6.08E-05	3.46E-06
		5,333	1.56E-05	8.89E-07	1.49E-05	8.50E-07
2x1700 MW_e	2020	1,333	9.65E-05	5.50E-06	9.59E-05	5.47E-06
		5,333	1.99E-05	1.13E-06	1.96E-05	1.12E-06
	2050	1,333	9.72E-05	5.54E-06	9.66E-05	5.51E-06
		5,333	1.99E-05	1.13E-06	1.97E-05	1.12E-06
	2080	1,333	9.72E-05	5.54E-06	9.66E-05	5.51E-06
		5,333	1.99E-05	1.13E-06	1.97E-05	1.12E-06
Temelín design	2020	1,333	1.68E-04	9.57E-06	1.67E-04	9.54E-06
		5,333	3.32E-05	1.89E-06	3.30E-05	1.88E-06
	2050	1,333	1.68E-04	9.57E-06	1.67E-04	9.54E-06
		5,333	3.32E-05	1.89E-06	3.30E-05	1.88E-06
Temelín measurement	2020	1,333	1.63E-05	9.29E-07	1.57E-05	8.94E-07
		5,333	5.42E-06	3.09E-07	5.19E-06	2.96E-07
	2050	1,333	1.63E-05	9.29E-07	1.57E-05	8.94E-07
		5,333	5.42E-06	3.09E-07	5.19E-06	2.96E-07

It follows from the table that the estimate of the doses received and of the life-long health detriment risk obtained from the calculation including separate data for adults and for children is negligibly different from that obtained by including the population as a whole. The risk remains at the levels of 10^{-6} and 10^{-7}, thus complying with the stringent international criteria.

A remarkable view upon the role of atmospheric discharges from the NNPP and existing NPP Temelín reactor units can be obtained by comparing them with the effects of the radiation background. The gamma dose rate from rocks in the Temelín area is 50-60 nGy/hr whereas at Týn nad Vltavou, Pašovice and Všemyslice it attains 60-90 nGy/hr. Using the conversion factor of 0.7 Sv/Gy (UNSCEAR 1998), this corresponds to 0.31-0.37 and 0.37-0.55 mSv/yr respectively. As to cosmic rays, their effect increases with increasing altitude. The mean altitude in the study area is about 300-500 m above sea level, where an effective dose of approximately 0.4 mSv/yr is delivered. Irradiation from medical examinations is estimated to 0.6-1 mSv/year per individual in the Czech population. The effective dose from radon in homes is about 2.6 mSv/yr in the houses examined in the study area. This matches the average irradiation from radon in the Czech Republic. Summing up the above local effective doses from the background, a total mean value of 4.2 mSv/year is obtained, and the risk derived from it is 2.39E-4. A comparison with the annual risk (i.e. with 1/70 of the life-long committed doses given above) at the distance of the nearest-lying residential houses (1,333 m), of Týn nad Vltavou (5,333 m) and at the largest distance evaluated (21,677 m) is given in the table below.

Table D.I.9: Comparison of the annual health detriment risk [-] from the radiation background and from atmospheric discharges from the reactor units considered (2020)

	1,333 m	5,333 m	21,677 m
Background	2.39E-04	2.39E-04	2.39E-04
2x1200 MW_e	4.31E-08	1.05E-08	3.16E-09
2x1700 MW_e	7.81E-08	1.61E-08	3.42E-09
Existing NPP Temelín units – design	1.37E-07	2.69E-08	5.11E-09
Existing NPP Temelín units - measurement	1.28E-08	4.23E-09	1.60E-09

The table demonstrates that in comparison with the local radiation background, the design data of the new sources are 4 orders of magnitude lower in the nearest area and 5 orders of magnitude lower at a distance of 21 km. At Týn nad Vltavou (5,333 m distance) the risk derived from measurements of atmospheric discharges from the existing NPP Temelín reactor units is an additional order of magnitude lower. It will thus be clear that the health impacts of the NNPP (2 power alternatives) and the existing NPP Temelín units constitute a negligible fraction of the impacts of the background comprising natural sources and other man-made sources.

Risk from discharges into watercourses

Data of effective doses and committed effective doses from discharges into watercourses for a representative individual are given in Section D.I.3.3,Effects of ionising radiation (this document, page 407). As far as discharges into watercourses are concerned, the data (relative to the use of water) include calculations of migration of the radioactive substances and their daughter products in the aquatic environment and estimates of the effect of swimming in the contaminated water, driving motorboats, residing on the sediment, residing on irrigated soil, ingestion of drinking water, ingestion of fish living in the contaminated water, ingestion of meat and milk of animals watered with contaminated water and ingestion of agricultural produce contaminated by the irrigation. The above exposure pathways were considered for all age groups.

The annual effective doses and committed effective doses from the annual intake from discharges into watercourses are summarised in the table below.

Table D.I.10: Effective doses and committed effective doses [Sv/yr] from annual use of water individually referneced from the population

Age group	2x1200 MWe	2x1700 MWe	NPP Temelín units - design	NPP Temelín units - measurement
[years]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
0 to 1	1.05E-06	1.82E-06	2.12E-07	6.93E-07
1 to 2	8.61E-07	1.50E-06	1.67E-07	5.48E-07
2 to 7	9.63E-07	1.67E-06	1.90E-07	6.24E-07
7 to 12	7.56E-07	1.36E-06	1.48E-07	4.88E-07
12 to 17	6.35E-07	1.18E-06	1.20E-07	3.98E-07
Adults	1.02E-06	1.76E-06	1.68E-07	5.75E-07

* ... from the maximum of the values of the radionuclides measured in the discharges from 2006 to 2008

The above data are intended to characterise annual effective doses and committed effective doses received by the population in the area downstream of the discharges into the Vltava River (Pašovice and Neznašov). In fact, the scenario for the above exposure pathways includes a highly overestimated and absolutely unrealistic assumption that all the drinking water demands by the exposed population are satisfied directly from the Vltava River. This assumption, included in the mathematical model, has its historical background. Today, however, it does not agree with the concept of ICRP Recommendation 103 (or 101) because whoever is involved is not a "representative individual" who "reasonably represents the life habits of the group of persons". Really, no group of people and no individual exist who take all drinking water directly from a river in their "daily life".

The table demonstrates that the annual effective doses and committed effective doses are not very different for the different age groups. The levels are somewhat higher in the first year and are largely in the same order of magnitude.

The health detriment risk was calculated similarly to that from atmospheric discharges, i.e. for 70 years of life, by applying the approach where the calculated effective doses and committed effective doses for the various age groups are multiplied by the appropriate numbers of years within the 70 year period, and the sum of the products so obtained is multiplied by 0.057 Sv^{-1} (ICRP Recommendation). The results of the calculations are shown in the table below:

Table D.I.10: Lifelong sum of effective doses and committed effective doses [Sv] and the health detriment risk derived from them [-]

	2x1200 MWe	2x1700 MWe	NPP Temelín units - design	NPP Temelín units - measurement

Life-long dose [Sv] *	6.77E-05	1.18E-04	1.16E-05	3.93E-05
Detriment risk [-]	3.86E-06	6.71E-06	6.6E-07	2.24E-06

* ... sum of effective doses and committed effective doses over 70 years of life

It is clear from the results that even in the complete scenario comprising all the possible exposures, including the absolutely unrealistic assumption that river water is used as drinking water, the calculated total risk of health detriment from liquid discharges immediately downstream of the point where they are discharged into the Vltava is in the order of magnitude of 10^{-6} (for either power alternative of the nuclear source) and hence, complies with stringent international criteria. And since the actual exposures are substantially lower than as assumed in the scenario, the real risk to the population at the most contaminated river segment is much lower still and actually negligible. This also applies to the parallel operation of either of the power alternatives of the new source and the existing NPP Temelín reactor units.

D.I.1.1.2.5. Conclusions

The following conclusions regarding the radiation effects can be drawn from the assessments performed:

1. Even in a highly conservative setting, the life-long risk of health detriment to the critical subpopulation arising from atmospheric discharges is at the levels of 10^{-6} to 10^{-7}; this applies to either of the new nuclear reactor power alternatives to the year 2020, as well as to the horizons of 2050 and 2080. This risk level complies with the stringent international criteria.
2. The conclusion sub 1 also applies when taking into account the effective doses and committed effective doses for child ages.
3. For the existing 2 reactor units, the actual risk derived from atmospheric discharge measurements for the nearest-lying residence area is one order of magnitude lower than the risk calculated from the units' design data. This demonstrates that the conservative data used are highly overestimated while the reality is considerably more favourable than the calculated design assumptions.
4. Addition of the committed effective doses from current existing NPP Temelín units operation to either of the NNPP source alternatives does not change the order of magnitude of the resulting committed effective doses and the figures change only slightly. In other words, the sum of the effects of the new sources and the burden from the 2 existing NPP Temelín reactor units is well acceptable from the health protection aspect (especially when considering the conservatism of the scenario applied and, in particular, of the ingestion pathway).
5. The risks arising from the NNPP sources plus the existing NPP Temelín reactor units operation are 4 orders of magnitude lower that the risks arising from the natural radiation background.
6. Nuclear fuel transports and the MAPE lagoon at Mydlovary play virtually no role in the radiation burden to the population in the NPP Temelín surroundings.
7. The health detriment risk from the discharges into watercourses is very low as well, being in the order of magnitude of 10^{-6}. Such a risk level complies with stringent international criteria. Radiation contamination of the Vltava River is insignificant as far as health impacts are concerned. In the current situation, as well as if the new sources are operated, water from the Vltava River downstream of Kořensko complies with stringent international criteria even if all the conceivable direct and indirect exposure pathways are considered, and from the radiological aspect, this water suits drinking purposes without additional dilution (especially in view of the fact that the conservative assumption of systematic ingestion of water as drinking water is in reality absolutely unrealistic).

D.I.1.1.3. Non-radiation effects

D.I.1.1.3.1. Identification of effects relevant from the public health aspect

The operation of the NNPP reactors at the NPP Temelín site can impact the population both directly from the area where they are sited, and through the associated transport. Additional effects may arise from electric and magnetic fields in the vicinity of electrical facilities and high voltage lines (power output). No other significant non-radiation effects on public health are conceivable. The following factors are considered:

- air pollution,

- noise,
- electric and magnetic fields.

The above factors are assessed both for the period of operation and for the period of preparations and construction, the latter period being analysed in a separate section.

D.I.1.1.3.2. Air pollution

The assessment of the health impacts of air pollution is based on the results of the assessment of the effect on air, reported in Section D.I.2,Effects on the air and weather (this document, page 396). The effects on the air are assessed for point sources and for line sources related to transport (traffic).

Point sources

Point sources include diesel-generator stations or internal-combustion turbines and cooling towers. Those sources are dependent on the new nuclear installation power alternative. Air pollution by carbon monoxide (CO), nitrogen dioxide (NO_2) and suspended particulate matter fraction PM_{10} was assessed for 2 power alternatives. Air pollution by ammonia from the cooling towers was assessed for 3 alternatives.

Air pollutant concentrations in nearby residential areas derived from cartographic materials are given in the tables below. The data for the majority of the pollutants are accompanied by local background data. Data with asterisks only include the point sources assessed.

Table D.I.11: Air pollutant concentrations [µg.m^{-3}] at nearby residential sites, 2x1200 MW$_e$ power alternative

Site	CO 8 hr	NO_2 year *)	NO_2 hr	PM_{10} year *)	PM_{10} day
Temelín	1,010	< 0.005	20	< 0.005	35
Všemyslice	< 1,010	< 0.005	14	< 0.005	28
Bohunice	< 1,010	< 0.005	13	< 0.005	24
Týn n. Vlt.	< 1,010	< 0.005	12	< 0.005	< 20
Zvěrkovice	< 1,010	< 0.005	15	< 0.005	24
Litoradlice	< 1,010	< 0.005	15	< 0.005	28
Kočín	1,010	< 0.005	17	< 0.005	29
Dříteň	< 1,010	< 0.005	< 15	< 0.005	26
Malešice	< 1,010	< 0.005	< 15	< 0.005	24
Sedlec	< 1,010	< 0.005	< 15	< 0.005	25
Lhota pod Horami	< 1,010	< 0.005	< 15	< 0.005	28
Limit	10,000	40	200	40	50

*) contribution from the sources assessed only

Table D.I.12: Air pollutant concentrations [µg.m^{-3}] at nearby residential sites, 2x1700 MWe power alternative

Site	CO 8 hr	NO_2 year *)	NO_2 hr	PM_{10} year *)	PM_{10} day
Temelín	1,060	0.001	16	0.003	35
Všemyslice	1,025	< 0.001	11	< 0.001	26
Bohunice	1,025	0.002	10	0.002	25
Týn n. Vlt.	< 1,020	0.001	< 10	0.001	20
Zvěrkovice	1,030	0.002	11	0.004	25
Litoradlice	1,035	0.002	13	0.003	28
Kočín	1,040	0.002	13	0.004	28
Dříteň	1,025	0.001	11	0.002	< 30
Malešice	1,025	< 0.001	11	< 0.002	< 30
Sedlec	1,032	< 0.001	12	< 0.002	< 30
Lhota pod Horami	1,032	< 0.001	12	< 0.002	< 30
Limit	10,000	40	200	40	50

*) contribution from the sources assessed only

Background concentrations of 4 µg.m^{-3} and 15 µg.m^{-3} have been reported for the mean annual NO_2 and PM_{10} concentrations, respectively. Those data should be added to the levels arising from the pollutants for which the sources evaluated are responsible, when evaluating compliance with the limiting levels.

The two tables demonstrate that the pollutant concentrations largely constitute very small fractions of the regulatory limits and are irrelevant from the public health aspect. Short-time daily (24h) PM_{10} levels are an exception, representing, in combination with the background, up to 70% of the limit. Even so, they comply with the public health aspect.

Ammonia from the cooling towers is the next substance to be evaluated. No valid limit has been set for ammonia by the authorities. Therefore, the associated risks have been assessed.

Ammonia (NH_3) is a colourless alkaline gas with a pungent odour. It finds wide use in cooling equipment and in the manufacture of plastics, fertilisers and pharmaceuticals. It is a normal decay product of animal wastes, especially excrements. In the natural environment, ammonia is formed constantly by the decomposition of nitrogen substances and subsequently degraded. Being taken up fast by plants and microorganisms, ammonia does not remain long in the environment. Ammonia remains for roughly a week in air. However, being considerably lighter than air, ammonia rises rapidly to higher layers of the atmosphere. In the ground air layer, ammonia partly remains dissolved in water droplets.

Its very high solubility in water contributes to its harmful effect on the mucous membranes of the eyes, nose, mouth, larynx and bronchi. Causing strong alkalinisation, ammonia is a skin irritant (ammonium hydroxide formed from it in water is a strong base exerting corrosive effects). Ammonia in the air can be smelled at concentrations of 30 $mg.m^{-3}$ and higher. The first signs of effect on mucous membranes (occasional mild irritation of the eyes and throat and provocation of cough) can appear at concentrations above 35 $mg.m^{-3}$.

NOAEL for inhalation exposure to ammonia is 6.4 $mg.m^{-3}$ (US EPA). This level is based on lung performance reduction measurements and on manifestations in the respiratory tract in animal studies. No such effect, however, has been demonstrated in humans at the above NH_3 concentration in air. Based on the above NOAEL, the RfC (reference inhalation concentration) level of 0.1 $mg.m^{-3}$ (i.e. 100 $\mu g.m^{-3}$) has been derived by US EPA by applying a safety factor and an uncertainty factor. LOAEL, i.e. the lowest concentration that induced the first adverse effects (aggravating rhinitis and pneumonia affecting the airway) at long exposures, is 17.4 $mg.m^{-3}$. It is clear that a wide safety margin exists above the RfC level mentioned.

Exposure to ammonia in the affected area is directly proportional to its concentrations in air. Due to the large height of the cooling towers, the highest air pollution levels are not observed in the closest vicinity to the plant. Instead, the level increases with increasing distance from the plant to peak at several hundreds of kilometres and decrease with distance beyond this peak. The shape of the ground plays a role as well. The largest concentrations are observed on the northern slopes of the eastern part of the Bohemian Forest. The mean annual pollutant concentrations are 1 to 1.5 $ng.m^{-3}$ in dependence on the source type, the maximum short-time (hourly) concentrations are 200 to 350 $ng.m^{-3}$. Ammonium concentrations in the air at the centres of larger residential areas are given in the table below.

Table D.I.13: Concentrations of ammonia in the air [$ng.m^{-3}$] in residential areas in the NPP Temelín surroundings

Area	2x1200 MW_e		2x1700 MW_e	
	NH_3 year	NH_3 max	NH_3 year	NH_3 max
Bechyně	0.1	21.0	0.1	25.0
České Budějovice	0.3	22.0	0.3	24.0
Hluboká n.V.	0.3	19.0	0.2	23.0
Lomnice n.L.	0.5	31.0	0.5	33.0
Netolice	0.3	19.0	0.4	21.0
Písek	0.2	16.0	0.2	19.0
Protivín	0.2	26.0	0.2	32.0
Soběslav	0.3	26.0	0.4	28.0
Třeboň	0.5	38.0	0.5	44.0
Veselí n.L.	0.4	26.0	0.4	28.0
Vodňany	0.2	21.0	0.2	26.0

Comparison of the tabulated data with the above reference concentration (100 $\mu g.m^{-3}$, or 100,000 $ng.m^{-3}$) shows that air pollution levels in the nearby South-Bohemian towns is 4 to 6 orders of magnitude lower. The pollution is at a trace level, posing no health hazard at all. This also applies to the above maximum levels observed on the foothills of the Bohemian Forest (Šumava), where the pollution is 3 to 5 orders of magnitude lower than the RfC value.

Line sources

Line sources are sources which are associated with transport (road and rail transport) servicing the NNPP. Model calculations have been performed for nitrogen dioxide, PM_{10}, benzene, CO and benzo[a]pyrene (BaP).

It is clear from the results reported in Section D.I.2, Effects on the air and weather (this document, page 396), that transport servicing the NNPP during operation will impose no significant burden on the surroundings. The short-time limit for PM_{10} will be exceeded one or two times in a year in some through-traffic towns or villages. Hence, the health burden from line sources is acceptable.

D.I.1.1.3.3. Noise

Assessment of the health impacts of noise is based on the results of assessment of the effect of noise given in Section D.I.3.1, Effects of noise (this document, page 404). The effects of noise are assessed for fixed sources (technology) and for line sources associated with transport/traffic.

Noise is among typical and severe harmful factors in the environment in developed countries. Even at levels near the basic limits, noise affects the whole exposed population. A large fraction of urban populations is thus affected today. However, large differences in the sensitivity to noise exist between individuals, in dependence on each individual's nervous system, health, age, etc. The fraction of individuals really sensitive to noise among the Czech population is estimated at 5 to 8%. On the opposite side is a similar group of individuals who are rather resistant to noise. In the remaining population, the effect increases with increasing noise intensity (also in dependence on a number of other factors). The effects of disturbing noise are somewhat different during the day and at night.

Elevated daily noise levels primarily affect the human nervous system and mental state. In this way, high noise levels can even contribute to psychosomatic disturbances. High noise levels give rise to:

a) interferences (with activities such as mental work, speech, sleep, etc.)

b) discomfort - a feeling of disturbance, annoyance, aversion associated with forced perception of sounds to which the individual has a negative attitude

c) feeling of being annoyed by unacceptable effects on the environment and violation of individual and group rights,

d) changes in social behaviour (consideration, willingness to help and ability to cooperate are lower in a noisy environment, overall annoyance and aggressiveness increase).

The subjective feeling of discomfort and annoyance from noise is associated with the emotional component of perception. All this is a result of impaired mental comfort. The emotional experience is not necessarily dependent on the intensity of the noise stimulus. Still, people are more annoyed in environments with higher noise levels.

Direct health impacts only occur at higher intensities. The equivalent level of 65 dB during the day is the absolute limit for residential areas from the health risk aspect. A favourable climate of acoustic comfort for the recovery of one's working abilities exists outdoors at equivalent levels below 50 to 55 dB. Mental comfort is disturbed as described above if noise exceeds those levels.

Full protection of individuals sensitive to noise is not ensured even if the basic limit of 50 dB is complied with. Approximately 10% of people are still annoyed by noise. The fraction of affected individuals increases with the increasing intensity of noise. On the other hand, some people get accustomed to noise in time and their sensitivity to noise decreases.

Elevated night noise levels affect the population exposed by disturbing the process of falling asleep as well as the length and quality of sleep. The effect depends on the individual sensitivity of people, which is very different between individuals: the differences between the levels of the noise stimuli affecting individuals can be as high as 25 to 30 dB. Apart from the differences caused by the different constitution of people, the sensitivity to noise is also affected by the individual's age: people grow more perceptive to sleep disturbing effects with increasing age. On the other hand, this sensitivity can be somewhat reduced by poorer hearing. The frequency width also plays a role: narrow-band noise acts more intensely.

Peaceful and undisturbed sleep is considered a necessary condition for good health and physic and mental power. The quality of sleep is affected by noise even if the person does not wake up (or is not aware of a short awakening). The sleep is less deep and the sleep phases that are most important for the recovery of one's physical and mental strength are limited. If the individual is aware of having been awakened, it is often difficult for them to fall asleep again, one feels annoyed and perceives harm. Experiments have shown that one's attentiveness, performance and ability to concentrate are reduced during the day following such a night. In order not to disturb sleep, the noise level should not exceed 35 to 37 dB(A).

Based on the above findings, extracted from the literature, the assessment that follows uses basic limits for equivalent noise at levels of 50 dB during the day and 40 dB at night. The upwards corrections permitted by current legislation (Government Decree no. 148/2006) are reasonable from the legal, not physiological aspects. People are annoyed by noise of a certain level independently of whether a correction is permitted for that site or not.

As mentioned above, literature describes feelings of annoyance and discomfort due to noise during the day. A modern method for quantification of the effects has been elaborated recently (2003) by the TNO institute in Leiden, The Netherlands, based on a number of epidemiological studies from Europe, North America and Australia. Based on the studies, scientists at TNO derived a relationship between the street noise levels and annoyance by noise in the population during the day and the level of sleep disturbance at night. The method has been accepted by the WHO and has been applied to the description of the risk to the population. Based on epidemiological studies, TNO also identified the lowest equivalent street noise levels [dB(A)] below which no direct health impacts have been observed. For day noise, the levels are 70 dB for an increased blood pressure and 65 to 70 dB for an ischemic heart disease. For night noise, the limit is 40 dB for a good quality of sleep, less than 60 dB for a good mood the next day, and also less than 60 dB for a good performance the next day.

Fixed sources (technology)

Noise has been assessed both for the current situation and for the future situation with the new nuclear reactors operable. Noise from all relevant technology sources was considered, including the Kočín substation. The highest performance levels were assumed for all the sources. Noise analyses revealed that the basic limit may be exceeded slightly at some sites (3 points in Kočín at a height of 12 m and the periphery of the village of Temelín at all heights evaluated). Efficient noise barriers have been proposed for those affected sites and the effect achieved has been calculated. Only the resulting situation is evaluated here because the implementation of the noise barriers is desirable. The results are given in the table below.

Table D.I.14: Equivalent noise levels [dB(A)] from the operation of technology

Point	Situation	Height 3 m	Height 6 m	Height 12 m
MB01 Litoradlice	Current	28.2	29.2	29.5
	Future	28.9	29.8	30.1
	Difference	+0.7	+0.6	+0.6
MB02 Knín	Current	29.8	32.5	34.2
	Future	30.4	33.5	35.2
	Difference	+0.6	+1.0	+1.0
MB03 Kočín, sv. okraj	Current	36.7	38.2	38.7
	Future	37.9	39.1	39.7
	Difference	+1.2	+0.9	+1.0
MB04 Kočín, ne. periphery	Current	37.8	38.4	39.1
	Future	38.6	39.2	39.9
	Difference	+0.8	+0.8	+0.8
MB05 Kočín, SW periphery	Current	37.5	38.8	39.5
	Future	36.9	37.9	38.7
	Difference	-0.6	-0.9	-0.8
MB06 Malešice	Current	30.1	31.3	32.6
	Future	31.9	33.1	34.3
	Difference	+1.8	+1.8	+1.7
MB07 Sedlec	Current	26.6	28.2	29.0
	Future	31.3	32.4	33.0
	Difference	+4.7	+4.2	+4.0
MB08 Temelín	Current	32.0	32.9	33.3
	Future	37.6	37.8	38.1
	Difference	+5.6	+4.9	+4.8

The table demonstrates that all equivalent noise levels comply even with the basic limiting level for noise at night (40 dB), even if the NNPP contributes, and are thus acceptable from the public health aspect. This, however, is conditional on the implementation of noise abatement provisions.

Line sources

The results of analyses of the noise effects demonstrate that traffic associated with the new nuclear power source will increase the equivalent noise levels in the affected towns and villages by insignificant increments (0.0 dB to 0.3 dB during the day and 0.0 dB to 0.6 dB at night). Such extremely low increments cannot be perceived by humans and, lying within the limits of uncertainty of measurement, cannot be discerned by measurement. To sum up, the effect of future traffic associated with NPP Temelín operation including the NNPP can be considered acceptable from the public health aspect.

D.I.1.1.3.4. Electric and magnetic fields

The construction of the new nuclear installation will be associated with the reinforcement of the 400 kV and 110 kV line corridor between NPP Temelín and the Kočín switchyard. For assessment of the associated electric and magnetic fields and induced current density see Section D.I.3.4,Effects of non-ionising radiation (this document, page 445).

Based on calculations with conservative assumptions, the minimum height of the 400 kV line wires was determined to be 12.8 m for the least favourable phase sequence and 12.1 m for the most favourable phase sequence. The minimum height for the new 110 kV line was determined to be 6 m, which is satisfactory irrespective of the phase sequence. If those conditions are met, the requirement contained in Government Decree no. 1/2008 on health protection from non-ionising radiation will be complied with. Moreover, the area is not inhabited permanently.

D.I.1.1.4. Psychological effects

Disturbing psychic effects may arise from the associated road traffic and from potential concerns about the increased risk associated with the expansion of the plant.

Traffic increase during the future plant operation will not be appreciable and, presumably, will not be perceived very much in the through-traffic towns and villages. At a few sites only (Temelín, Albrechtice nad Vltavou, Všeteč) the annoyance from traffic may increase slightly during the (limited) construction period.

Increased concerns about the existence of NPP Temelín and the associated potential risks may appear, particularly during expected actions by opposers of the use of nuclear power and/or unfair presentation of alleged hazards. However, no appreciable effects are expected because the population has accepted NPP Temelín's existence in the vicinity as a more or less normal thing (see Chapter C.2.1.3, Psychological condition of the population, page 236 of this document).

Nevertheless, it is necessary to continue to be very cautious in contacts with the public, to openly and fully inform the public about all circumstances of NPP Temelín operation. The public must not have the feeling that any issue is being hidden from them. This will be particularly important during the stages of project preparation and new nuclear installation construction, when actions to cast doubt on the safety of nuclear power may become quite vigorous once again. The existing trust of the public in the NPP Temelín operational safety, mirrored by their attitude to daily life, may be disturbed very quickly.

D.I.1.1.5. Effects on the plant personnel

This issue is actually not subject to environmental impact assessment as stipulated by Act no. 100/2001 Coll., on environmental impact assessments. The facts discussed below are thus of supplementary, informative nature only.

Radiation protection of the new nuclear power source personnel will be ensured in compliance with applicable legislation, and its standard will be no lower than that of the existing radiation protection at the Temelín or Dukovany reactor units (for more detail see Section C.2.1, Population and public health (this document, page 223), specifically subsection C.2.1.2.6,Examination of the effects on plant personnel). Thus, plant personnel/employees will not be endangered as far as radiation protection is concerned.

As regards non-radiation aspects (noise, vibrations, dust, non-ionising radiations, etc.), applicable legislative and regulatory requirements, limits and requirements imposed by public health authorities will be complied with.

D.I.1.2. Social and economic effects

2. PROJECT (UNITS 3+4)

No changes in the residential structure of the area (demolition of residential houses, displacement of inhabitants, etc.) will be necessary for the project. On the contrary, the new nuclear power source will be sited in an area where appropriate space and infrastructure exist from the previous time period. Hence, no social impacts from a forced displacement of inhabitants are induced.

The project is not associated with any activity resulting in a significant change in the existing arrangement of the area. Relations to real estate in the area are stable, also with respect to the existing power plant operation. Hence, no appreciable changes in the current ownership relations or prices of land are expected. If any, then this may rather be towards increased demands with a view to providing homes to the new plant employees and employees of the construction companies during the construction of the new nuclear installation.

From the economic aspect, the project will play an important favourable role in that many new jobs will be created in the construction and operation of the new nuclear reactors and in the associated services. The construction staff will encompass some 3,000 employees. Another 600 qualified experts will be recruited for the operation of the plant.

PLANT (UNITS 1+2+3+4)

D.I.1.2.1. Effects on employment

Currently (2008), the plant has a staff of approximately 980. The final number of personnel will be about 1,500 after the new reactors are made operable.

Currently the South-Bohemian region is coping with the impacts of depression and employment problems. The construction of new reactor units at Temelín may contribute to a mitigation of the problems in the region. The extension of the plant will be associated with new jobs. They will be long-lasting jobs because the life of the new reactor units is planned for 60 years as a minimum. Construction of the units and preparatory work for it will offer job opportunities to Czech employees, as well as business opportunities to many contractors.

Operation of the power plant is not associated with any winding-up of businesses (Czech Statistical Office data). On the contrary, the number of businesses has increased considerably since 1995. The number of businesses was higher in 2008 as compared to 1995, by 122% in Dříteň, 97% in Olešník, 52% in Temelín, 60% in Týn nad Vltavou and 60% in Všemyslice. There is no reason why the new installation should bring about winding-up of businesses. Due to the specific business segment, i.e. electricity generation, the plant does not compete with local businesses, nor does it create an unfavourable business environment. On the contrary, the plant offers new opportunities in the segment of services for the plant staff (catering, accommodation, leisure activities, etc).

D.I.1.2.2. Effects on tourism

The Temelín Power Plant does not affect tourism in the region. And there is no reason why the plant extension project should have any significant impact upon the numbers of tourists coming to the South-Bohemian region (or the surrounding regions) in order to visit historical monuments, cultural events or enjoy the beauty of the locations.

The number of visitors of the South-Bohemian region was increasing from 1989 till the time that adverse global factors such as floods in 2002 and 2006, increasing value of the Czech crown against the Euro, and others started to impact tourism. This can be demonstrated on the town of Hluboká nad Vltavou, lying relatively close to the plant. Visitors are even coming with the specific desire to see the plant: the Temelín Information Centre records nearly 30,000 visitors annually. It is absolutely unconceivable that the plant should have any impact on the numbers of visitors of more remote sites such as the Šumava (Bohemian Forest) National Park (or its trans-boundary regions - the Bayerischer Wald), due to the distance (no visitor would associate the National Park with the plant) as well as to the fact that the power plant has no impact on the natural conditions there.

Should additional construction have any impact on tourism, then it's only as a consequence of abused negative campaigns or artificially induced actions (such as blocking of roads).

D.I.1.2.3. Effects on local developments

A marked growth of public facilities has taken place in the towns and villages in the plant's surroundings recently; this was also contributed to by the "ČEZ Foundation" regional grant programme. Examples of public facilities built in the towns/villages of Dříteň, Olešník, Temelín, Týn nad Vltavou and Všemyslice during the past years are given below.

Dříteň:	Nursing home, loft conversions, renovation of the kindergarten and elementary school buildings (new canteen), new playground, central generation of heat in a biomass-fired boiler house and its distribution to all homes, road repair, etc.
Olešník:	New gas distribution system, construction of a wastewater treatment plant and a sewer conduit, swimming-pool reconstruction, renovation of the kindergarten and elementary school buildings, road reconstruction, etc.
Temelín:	Water mains, new gas distribution system, school building renovation, multi-purpose facilities, football field, public library, pub, shop, fire station, etc.
Týn nad Vltavou:	Renovation of the nursing home, two supermarkets, renovation of the bus station, renovation of the kindergarten, elementary and secondary school buildings, renovation of housing estates, reconstruction of the infrastructure, etc.
Všemyslice:	A multi-purpose facility, playing field, gas distribution system, water mains, street lighting, road reconstructions, etc.

In early 2009, ČEZ and the government of the South-Bohemian Region signed a 10 year Framework Cooperation Agreement. During the 10 years, the South-Bohemian region should be granted a total sum up to CZK 3.7 billion. In May 2009, the regional agreement was detailed for 5 towns/villages within 5 km of the Temelín Power Plant. This is also a 10-year model of cooperation within which Týn, Temelín, Dříteň, Všemyslice and Olešník will together be supported with a sum of CZK 300 million. The funds will primarily be used for infrastructure development, i.e. repairs of streets and roads, street lighting, playgrounds for children, reconstructions/renovations of public buildings, school and kindergarten buildings, etc. The municipalities will be free to use the money in combination with European subsidies, thereby increasing their financial resources. At any rate, the funds should help improve community facilities in the towns/villages in the plant surroundings.

D.I.1.3. Effects during the preparation/construction period

D.I.1.3.1. Radiation effects

Radiation effects will be insignificant during the project preparation and implementation period. The use of routine instruments using ionising radiation (such as X-ray NDT) during the construction stage is conceivable. Any such facility will be a certified system and its use will comply with the relevant technical and safety specifications, without any impact on the population.

The existing Temelín Power Plant reactor units will be operable during the project preparation/implementation stage. The construction of the new nuclear installation will not affect discharges from the existing units and hence, the currently insignificant effects on the population in the affected area or on public health will not be aggravated by the construction activities.

D.I.1.3.2. Non-radiation effects

As far as adverse effects accompanying the preparation and implementation of the construction project is concerned, air pollution and noise will contribute significantly.

D.I.1.3.2.1. Air pollution

The assessment of the health impacts of air pollution during the construction stage is based on the results of assessment of the effect on the air, described in Chapter D.I.2,Effects on the air and weather (this document, page 396). Effects on air include (i) dust generation during the construction work and (ii) effects of operation of building mechanisms and traffic during the construction phase.

Dust at the construction site

Dust at the construction site arises from surface stripping and ground levelling, material loading on trucks and unloading at arable land and earth collection sites, material relocation with scrapers, and truck and machine motion at the site.

The mean annual PM_{10} concentration arising from the removal of soil from the site, including background and resuspension, is lower than 16 $\mu g.m^{-3}$ in the nearest town/villages (Temelín, Kočín). Excavation work leads to an analogous level of 20 $\mu g.m^{-3}$. Hence, the applicable limit, i.e. 40 $\mu g.m^{-3}$, will be obeyed (with a high margin).

The highest short-time (24-hr) concentrations in the air in Temelín during soil removal, including resuspension and pollution background, will reach above-the-limit levels of 200-250 $\mu g.m^{-3}$ at a frequency of once or twice a year. Applicable legislation permits the short-time limit to be exceeded up to 35 times in a calendar year. Hence, the expected effect is compliant in this aspect. Nevertheless, improved dust control provisions on the working surfaces and roads will be highly desirable.

Peak short-time air pollution levels from excavation work will be higher still, reaching 500-600 $\mu g.m^{-3}$ including resuspension and air pollution background. They are extremely high levels as compared to the regulatory limit of 50 $\mu g.m^{-3}$. The limit will apparently be exceeded quite frequently and the periods will be extended by 2 to 4 days in Temelín and Kočín due to the excavation work. Fortunately, the period during which such type of ground work is performed will be rather short and the pollution peaks can only appear in very unfavourable weather conditions. Improvement of dust control provisions, however, will be necessary.

The health impacts of the short-time pollution levels cannot be quantified by the Risk Assessment approach because risk factors (tentative anyway) are only available for annual averages.

Effect of construction machines

Air pollution sources include, in particular, traffic mechanisms, which operate over a very wide area of the construction site. Engines (truck-mounted cranes, loading machines) and the auxiliary boiler house also contribute to air pollution. The deployment of construction mechanisms is scheduled for a 6-year period, with a peak roughly in the middle of the construction cycle.

Analyses have been performed for nitrogen dioxide (NO_2), PM_{10}, benzene, CO and benzo[a]pyrene (BaP). The results, presented in the form of a layout, show that the effect of operation of the auxiliary boiler house and building machines is most pronounced at the site and does not burden the surroundings. Thus this effect is irrelevant from the public health aspect.

Traffic associated with construction activity

The effect of traffic associated with construction work consists in an increase in the road and rail traffic during the construction phase of the project. Thus, the pollution sources are line sources, encompassing roads and railways (diesel locomotives).

Model calculations have been performed for CO, NO_2, PM_{10}, benzene and benzo[a]pyrene. The results are presented in layouts.

Nitrogen dioxide in the air of the nearby residential areas arising from total traffic (background included) attains its mean annual maxima, 10-12 $\mu g.m^{-3}$ in some points at Týn nad Vltavou and Zvěrkovice. This level is substantially lower than the regulatory limit (40 $\mu g.m^{-3}$). Short-time limits are rarely (0 to 3 times in a calendar year) exceeded in the residential areas. Hence, NO_2 concentrations from road traffic are well acceptable from the public health aspect.

Dust in air (PM_{10}) from total traffic (background included) attains the highest annual concentrations of 26-28 $\mu g.m^{-3}$. This is fully satisfactory when compared to the regulatory limit (40 $\mu g.m^{-3}$).

The short-time (24-hr) peaks are described in terms of the number of times the regulatory limit is exceeded during a calendar year rather than in terms of the concentration levels. The numbers of times are given in the table below for selected towns/villages with relatively high dust burdens. The left column shows how many times the limit is exceeded due to total traffic, the right column shows how many times the limit will be exceeded due to traffic associated with the construction of the new nuclear installation. The figure admitted by the applicable Government Decree is 35 times in a year.

Table D.I.15: Figures showing how many times the short-time concentration PM_{10} exceeds the regulatory limit during a calendar year

Site	Total	Increment
Týn nad Vltavou	18-24	8-12
Zvěrkovice	6-12	4-6
Temelín	0-6	-
Sudoměřice u Bechyně	3-6	1-2
Žimutice	-	2-3
Bzí	-	2-3
Dolní Bukovsko	-	2-3

The table shows that the burden is highest in the northeastern traffic direction, especially at Týn nad Vltavou. Dust control provisions are desirable at sites with an appreciable dust burden during periods of heavy traffic (depending on the phase of the construction stage) and in dependence on the weather conditions. On the remaining traffic routes the situation is acceptable from the health aspect.

Carbon monoxide will apparently pose no health problem in the affected area. The expected 8-hr averages in the most exposed area (Zvěrkovice, Temelín) attain levels of 2,000-2,500 $\mu g.m^{-3}$, which is 20% to 25% of the regulatory limit (10,000 $\mu g.m^{-3}$).

Benzene is evaluated in annual averages only because this is a pollutant with chronic effects on humans. When compared to the regulatory limit (5 $\mu g.m^{-3}$) the situation is satisfactory: concentrations below 0.8-1.0 $\mu g.m^{-3}$ (background included), i.e. 25% of the limit, are obtained for the most burdened route at Týn nad Vltavou.

Benzo[a]pyrene, also evaluated by the annual averages only, will be highest in Zvěrkovice and in Týn nad Vltavou; the levels are 0.22-0.23 $ng.m^{-3}$ and < 0.21 $ng.m^{-3}$, respectively, hence, a little bit over 20% of the regulatory limit (1 $ng.m^{-3}$).

D.I.1.3.2.2. Noise

The assessment of the health impacts of noise during the construction phase is based on the data described in Chapter D.I.3.1, Effects of noise (this document, page 404). The effects of noise from the construction phase include (i) noise from work at the construction site and (ii) noise from road and rail traffic associated with the construction. Numerical results have been obtained both for selected reference points and in the form of very detailed noise maps. This document uses reference point data, which describe the noise burden in the exposed protected areas quite illustratively.

Exposure assessment

Reference points selected for assessing the effects of work at the construction site were largely located at the near peripheries of the nearest towns/villages. Their list is given in the table below. The calculations were performed for a level of 6 m above the ground.

Table D.I.16: Reference points selected to assess noise from the construction activities

Point, location	Distance (approximate) [m]
MB01, Litoradlice	4,200
MB02, Knín	2,500
MB03, Kočín, NE periphery	2,400
MB04, Kočín, NE. periphery	2,400
MB05, Kočín, SW periphery	2,600

MB06, Malešice	3,400
MB07, Sedlec	2,500
MB08, Temelín	1,000

The following activities were considered when assessing noise: removal of soil from the area reserved for construction facilities, removal of soil from the main construction site, excavation work at the main construction site, and construction of the power generation units and installation of technology. Construction work will only be performed during daytime and the calculations also include daytime work only. All the levels obtained are below the basic limit (50 dB). The table below includes results for 2 types of activity generating the highest noise in nearby residential areas.

Table D.I.17: Equivalent noise levels [dB] arising from construction activities

Point	Soil removal, area for construction facilities	Excavation work, main construction site
MB01	35.8	32.1
MB02	40.8	36.0
MB03	49.8	42.8
MB04	49.6	42.6
MB05	44.5	39.2
MB06	39.4	34.1
MB07	37.1	35.9
MB08	45.9	49.4

In order to assess the effects of associated traffic, road traffic was evaluated in detail along the routes to Písek, Sezimovo Ústí, Lomnice nad Lužnicí, Hluboká nad Vltavou, Netolice and Vodňany and rail traffic was evaluated for track no. 192 Čičenice - Týn nad Vltavou, including the siding to the plant area. The effects of the traffic were assessed in terms of the numbers of daytime and night time equivalent noise levels at the height levels of the 1st and 2nd floor (above ground) in 2015. Two variants were considered, not including and including the construction activity-related traffic. The difference between the two levels, i.e. the increase caused by traffic serving the construction project, is a factor relevant to the assessment of the effects of the project on public health. The difference is negligible, up to 1 dB, in the vast majority of the 50 reference points. So low a difference is insignificant from the public health aspect: it can neither be discerned by the human ear nor detected as an interfering or harmful effect. Therefore, only those reference points where the increment exceeds 1 dB are included in the table below, specifically for the floor where the difference was highest and, where the difference was identical, for the floor with the highest noise levels. There are 10 such points in total, the increments being lower in the remaining points.

Table D.I.18: Equivalent noise levels [dB] arising from traffic

Site, Point no.	2015 w/o		2015 with		Difference	
	Daytime	Night time	Daytime	Night time	Daytime	Night time
Albrechtice nad Vltavou 1	59.4	52.1	61.6	53.5	+2.2	+1.4
Temelín 3	62.9	56.9	64.8	57.9	+1.9	+1.0
Temelín 4	63.3	57.3	65.3	58.4	+2.0	+1.1
Temelín 5	64.3	57.8	65.6	58.5	+1.3	+0.7
Temelín 6	57.0	50.0	58.9	50.6	+1.9	+0.6
Temelín 7	59.8	52.7	61.8	53.5	+2.0	+0.7
Všemyslice 1	59.6	51.7	60.7	51.7	+1.1	±0.0
Všeteč 1	58.2	51.2	60.1	51.7	+1.8	+0.5
Všeteč 2	59.5	52.4	61.5	53.1	+2.0	+0.7
Všeteč 3	56.4	49.1	58.5	50.4	+2.1	+1.2

Risk description

The noise level increase is below the regulatory limit. It is acceptable from the public health aspect and is not analysed any more in the following text.

Both the daytime and night time traffic burden levels are above the basic limits (50 dB and 40 dB, respectively) in the traffic points of the exposed towns/villages, quite appreciably in some of them. And traffic serving the construction activities increases the levels additionally by a small increment. Points with the highest increments, i.e. Albrechtice nad Vltavou (Point 1), Temelín (Points 4 and 7) and Všeteč (Points 2 and 3), were selected for assessing the disturbance caused to the population by the traffic related to the construction phase of the project.

The epidemiological studies that formed the basis for deriving the above noise effect assessment methods used findings relating to inhabitants living in the various equivalent street noise level zones. Hence, this is the mean exposure of people living near traffic roads, as is the case in the examined area. Therefore, the above data for the assessment of the impact of noise on the population were used here as well.

Levels exceeding daily limits are perceived as nuisance, people are discomforted and annoyed, and this is among the typical and most sensitive measure of disturbance by noise. The fraction of the population annoyed by noise has been increasing. The acoustic descriptor L_{dn} was calculated for the daytime. In each of the two parts of the table below, the first two columns display the daytime and night time equivalent noise levels, the third column displays the calculated descriptor value.

Table D.I.19: Acoustic descriptor L_{dn} for selected reference points without and with traffic involved in construction activities

Site, point	2015, without			2015, with		
	Daytime	Night time	L_{dn}	Daytime	Night time	L_{dn}
Albrechtice nad Vltavou 1	59.4	52.1	60.5	61.6	53.5	62.3
Temelín 4	63.3	57.3	65.1	65.3	58.4	66.6
Temelín 7	59.8	52.7	61.0	61.8	53.5	62.4
Všeteč 2	59.5	52.4	60.7	61.5	53.1	62.1
Všeteč 3	56.4	49.1	57.5	58.5	50.4	59.2

The L_{dn} values served to derive the estimate of the fraction of population annoyed by daytime noise in the population exposed: LA = light annoyance, A = annoyance, HA = high annoyance. The results, for the starting situation not including and including traffic involved in the construction project, are given in the table below. The last line shows the annoyed fraction of the population in a setting where the basic daytime and night time limits (50 dB and 40 dB, respectively) are complied with; L_{dn} = 50.

Table D.I.20: Percent fraction of the population annoyed during the day by noise, not including and including traffic involved in construction activities

Point	Setting	L_{dn}	% LA	% A	% HA
Albrechtice nad Vltavou 1	without traffic for construction	60.5	50.0	27.0	11.1
	with traffic for construction	62.3	54.1	30.4	13.0
Temelín 4	without traffic for construction	65.1	60.4	36.2	16.6
	with traffic for construction	66.6	63.8	39.5	18.9
Temelín 7	without traffic for construction	61.0	51.1	28.0	11.6
	without traffic for construction	62.4	54.3	30.6	13.1
Všeteč 2	without traffic for construction	60.7	50.4	27.4	11.3
	with traffic for construction	62.1	53.6	30.0	12.8
Všeteč 3	without traffic for construction	57.5	43.2	21.8	8.4
	with traffic for construction	59.2	47.0	24.7	9.8
Limit		50.0	26.8	11.3	3.8

The last line demonstrates that a fraction of the population exists that is annoyed even if the basic limits are complied with. This fraction, though, increases quite markedly in the reference points, even in the absence of traffic involved in NNPP construction. The fractions of slightly annoyed, medium annoyed, and heavily annoyed people are increased by 16-34%, 11-25%, and 5-13%, respectively. This situation is little affected by the contribution from construction-related traffic. The fractions of slightly annoyed, medium annoyed, and heavily annoyed people are additionally increased by 3.2% to 4.1%, 2.6% to 3.4% and 1:4% to 2.3%, respectively.

At night, the degree of sleep disturbance is derived directly from night time noise levels. Once again, 3 categories are used. LSD = light sleep disturbance, SD = sleep disturbance, and HSD = high sleep disturbance. The results, for the starting situation not including and including traffic involved in the construction project, are given in the table below.

Table D.I.21: Percent fraction of population with sleep disturbed by noise, not including and including traffic involved in construction activities

Point	Setting	L_{dn}	% LA	% A	% HA
Albrechtice nad Vltavou 1	without traffic for construction	52.1	29.3	14.8	6.4
	with traffic for construction	53.5	31.1	16.1	7.2
Temelín 4	without traffic for construction	57.3	36.3	19.9	9.4
	with traffic for construction	58.4	37.8	21.1	10.2
Temelín 7	without traffic for construction	52.7	30.1	15.4	6.7
	with traffic for construction	53.5	31.1	16.1	7.2
Všeteč 2	without traffic for construction	52.4	29.7	15.1	6.6
	with traffic for construction	53.1	30.6	15.8	6.9
Všeteč 3	without traffic for construction	49.1	25.5	12.3	5.1
	with traffic for construction	50.4	27.1	13.4	5.6
Limit		40.0	15.3	6.5	2.6

Once again, it is clear that a fraction of the population is annoyed even if the basic limit is complied with and the fraction is considerably higher in the reference points even in the absence of traffic associated with the NNPP. The population fractions whose sleep is slightly disturbed, medium disturbed, and heavily disturbed are increased by 10.2% to 21.0%, 5.8% to 13.4%, and 2.5% to 6.8%, respectively. Traffic associated with the NNPP construction has little effect on this situation, increasing the 3 fractions by another 0.9% to 1.8%, 0.7% to 1.3%, and 0.3% to 0.8%, respectively.

Thus, the following conclusions can be drawn as regards the health impacts of noise produced by the construction work:

1. The noise level increase caused in the nearby residential areas by the building activities at the construction site is lower than as permitted by regulatory limits and hence, acceptable from the public health aspect.
2. The noise burden of the population in towns/villages lying on traffic routes is appreciable even without the contribution from the traffic associated with the construction of the new nuclear installation.
3. The contribution from traffic associated with the construction of the new nuclear installation is negligible (1 dB or less during the day) in the vast majority of the 50 reference points selected in 29 towns/villages.
4. Only in a few points the above contribution is somewhat higher than 1 dB (not exceeding 2.2 dB during the day). Also, in some of them only (Temelín, Albrechtice nad Vltavou, Všeteč) a fraction of disturbed population is increased appreciably. The introduction of individual noise control provisions should be considered at those sites (note: noise barrier walls are inapplicable).
5. The burden from the traffic associated with the construction work will be temporary, limited to a few years, and the traffic intensity will not reach the considered peak level during the entire construction phase.

D.I.1.4. Impacts during the shutdown period

The shutdown period will be associated with no additional radiation burden to the population as compared to the operation period.

The shutdown will be accompanied by a substantial decrease in atmospheric radioactive discharges (by approximately 3 orders of magnitude for noble gases and aerosols, approximately 1 order of magnitude for tritium, approximately 4 orders of magnitude for iodine radionuclides, and by approximately 1 order of magnitude for carbon) and liquid discharges (by approximately 3 to 4 orders of magnitude for total activity, tritium not included, and by approximately 1 order of magnitude for tritium). The subsequent shutdown stages will be associated with an additional decrease in atmospheric radioactive discharges (by approximately 2 orders of magnitude for noble gases and aerosols, approximately 2 orders of magnitude for tritium, approximately 1 to 2 orders for iodine radionuclides, and approximately 1 to 2 orders for carbon) and liquid discharges (by approximately 1 to 2 orders of magnitude for total activity, tritium not included, and by approximately 1 order of magnitude for tritium).

The health risks, assessed above, will decrease proportionally. Since the discharges during plant operation are acceptable from the public health aspect, the appreciably reduced levels will be acceptable as well.

As far as non-radiation effects during the shutdown period are concerned, the impacts of the demolition and dismounting work are expected to be commensurable with the impacts of the construction and installation work. Hence, once again, no significant differences from the above conclusions regarding the preparatory and construction stages are expected.

D.I.2. Impacts on the air and climate

D.I.2.1. Impacts on the air

2. PROJECT (UNITS 3+4)

Dispersion studies have been developed to assist in the assessment of the project's impacts on air quality. For the full text of the studies refer to the annexe. The conclusions drawn from them are highlighted below.

D.I.2.1.1.Point air pollution sources

The 2 power alternatives up to 1200 MW_e (in two settings: 2 cooling towers per reactor unit, and 1 cooling tower per reactor unit) and up to 1700 MW_e (in the setting of 2 cooling towers per reactor unit) were considered. The standby diesel-generators (or internal-combustion turbines), standby boiler house and cooling towers were included as the sources of pollution produced during the operation of the technological facilities. Neither the diesel-generators (or internal-combustion engines), neither the standby boiler house are permanently operated; instead, they are operated on an as-need basis for a limited number of days in a year. They are expected to be operated for less than 100 hours per year.

The calculation for the pollutants: CO, NO_2 and PM_{10} have been performed for a grid of calculation points covering an 11x11 km^2 area. The contribution of ammonia (NH_3) from the cooling towers was calculated for an area of 20x20 km, and also for a 75x80 km grid to assess transboundary migration.

The contribution to the CO, NO_2 a PM_{10} levels is highest within the power plant area. Air pollution near the NPP Temelín area boundary attains the maximum levels as given in the table below:

Table D.I.22: Highest CO, NO_2 and PM_{10} contributions to air pollution [$\mu g.m^{-3}$] in the area

	CO	NO_2		PM_{10}	
	8-hr peak	Yearly average	Hourly peak	Yearly average[2]	24-hr peak
2x1200 MW_e alternative	< 1,030	< 0.01	< 35	< 0.02	< 60
2x1700 MW_e alternative	< 1,100	< 0.006	< 30	< 0.02	< 60

[1] The table contains contributions from the sources evaluated only. Current background level of air pollution with NO_2 is 15 $\mu g.m^{-3}$.
[2] The table contains contributions from the sources evaluated only. Current background PM_{10} level is 4 $\mu g.m^{-3}$.

The following concentrations will be attained in the nearby towns/villages:

Table D.I.23: Highest CO, NO_2 and PM_{10} contributions to air pollution [$\mu g.m^{-3}$] in exposed towns and villages, calculated for the 2x1200 MW_e power alternative

	CO	NO_2		PM_{10}	
	8-hr peak	Yearly average[1]	Hourly peak	Yearly average[2]	24-hr peak
Limit	10,000	40	200	40	50
Temelín	1,010	< 0.005	20	< 0.005	35
Všemyslice	< 1,010	< 0.005	14	< 0.005	28
Bohunice	< 1,010	< 0.005	13	< 0.005	24
Týn nad Vltavou	< 1,010	< 0.005	12	< 0.005	< 20
Zvěrkovice	< 1,010	< 0.005	15	< 0.005	24
Litoradlice	< 1,010	< 0.005	15	< 0.005	28
Kočín	1,010	< 0.005	17	< 0.005	29
Dříteň	< 1,010	< 0.005	< 15	< 0.005	26
Malešice	< 1,010	< 0.005	< 15	< 0.005	24
Sedlec	< 1,010	< 0.005	< 15	< 0.005	25
Lhota pod Horami	< 1,010	< 0.005	< 15	< 0.005	28

[1] The table contains contributions from the sources evaluated only. Current background level of air pollution with NO_2 is 15 $\mu g.m^{-3}$.
[2] The table contains contributions from the sources evaluated only. Current background PM_{10} level is 4 $\mu g.m^{-3}$.

Table D.I.24: Highest CO, NO_2 and PM_{10} contributions to air pollution [$\mu g.m^{-3}$] in exposed towns and villages, calculated for the 2x1700 MW_e power alternative

	CO	NO_2		PM_{10}	
	8-hr peak	Yearly average[1]	Hourly peak	Yearly average[2]	24-hr peak
Limit	10,000	40	200	40	50
Temelín	1,060	0.001	16	0.003	35
Všemyslice	1,025	< 0.001	11	< 0.001	26
Bohunice	1,025	0.002	10	0.002	25
Týn nad Vltavou	< 1,020	0.001	< 10	0.001	20
Zvěrkovice	1,030	0.002	11	0.004	25
Litoradlice	1,035	0.002	13	0.003	28
Kočín	1,040	0.002	13	0.004	28
Dříteň	1,025	0.001	11	0.002	< 30
Malešice	1,025	< 0.001	11	< 0.002	< 30
Sedlec	1,032	< 0.001	12	< 0.002	< 30
Lhota pod Horami	1,032	< 0.001	12	< 0.002	< 30

[1] The table contains contributions from the sources evaluated only. Current background level of air pollution with NO_2 is 15 $\mu g.m^{-3}$.
[2] The table contains contributions from the sources evaluated only. Current background PM_{10} level is 4 $\mu g.m^{-3}$.

The contribution of ammonia (NH_3) from the cooling towers in the plant surroundings attains the following maximum levels:

Table D.I.25: Highest NH_3 contributions to air pollution [$ng.m^{-3}$] in the NPP Temelín surroundings

	NH_3	
	Yearly average	Hourly peak
2x1200 MW_e alternative	1.5	300
2x1700 MW_e alternative	2.0	340

At the Czech national border, the contribution will not exceed the following levels:

Table D.I.26: Highest NH_3 contributions to air pollution [$ng.m^{-3}$] in the Czech national border area

	NH_3	
	Yearly average	Hourly peak
2x1200 MW_e alternative	0.9	180
2x1700 MW_e alternative	1.1	200

In the nearby towns/villages, the contribution will not exceed the following levels:

Table D.I.27: Highest NH_3 contributions to air pollution [$ng.m^{-3}$] in towns and villages

	NH_3, 2x1700 MW_e alternative		NH_3, 2x1700 MW_e alternative	
	Yearly average	Hourly peak	Yearly average	Hourly peak
Limit	-	-	-	-
Bechyně	0.1	21	0.1	25
České Budějovice	0.3	22	0.3	24
Hluboká nad Vltavou	0.3	19	0.3	23
Lomnice nad Lužnicí	0.5	31	0.5	33
Netolice	0.4	19	0.4	21
Písek	0.2	16	0.2	19
Protivín	0.2	26	0.2	32
Soběslav	0.4	26	0.4	28
Třeboň	0.5	38	0.5	44
Veselí nad Lužnicí	0.4	26	0.4	28
Vodňany	0.2	21	0.2	26

All the concentrations are very low and by far do not attain levels relevant from the public health aspect or perceived by smelling (26,600 $ng.m^{-3}$).

D.I.2.1.2.Line sources of air pollution

Air pollution with CO, NO_2, SO_2, benzene, Pb and PM_{10} was evaluated within dispersion studies. The sources assessed included road traffic and rail traffic.

The results show that the regulatory limits will not be exceeded as a consequence of road traffic increase in the plant surroundings due to NNPP operation. The same conclusion is expected as regards roads in more distant areas, traffic intensity caused by NNPP operation being lower than in the nearer power plant surroundings.

In the near vicinity of some roads, the daily PM_{10} limit may be exceeded a few times more frequently when the NNPP reactor units are operable. However, it is unlikely that the limit for the daily PM_{10} average should be exceeded more frequently in the central area than as permitted by applicable legislation, i.e. 35 times during a year.

Model calculations indicate no air pollution increase in the area of interest due to a more intense rail traffic at the Číčenice - NNPP installation track during operation of the NNPP reactor units.

PLANT (UNITS 1+2+3+4)

The effect of the power plant as a whole has been commented on previously in the section devoted to the project (units 1+2). The contribution from the existing NPP Temelín operation is included in the air pollution background.

D.I.2.2. Effects on the climate

Assessment of the impact of the NPP Temelín cooling towers was the subject of a study conducted by the Institute of Atmospheric Physics, Academy of Sciences of the Czech Republic (see annexes hereto). Changes in ground air temperature and humidity, shading times and occurrence of fog have been calculated. The possibility of precipitation induced by the plume was also calculated and monitored. The examined area was 60x60 km^2. The central 10x10 km subarea was investigated in more detail. The conclusions of the studies are summarised below.

2. PROJECT (UNITS 3+4)

The assessment of the impact of the cooling towers on the climate parameters of the area around NPP Temelín demonstrated that the new cooling tower setting after the NNPP reactor units are made operable will have a minimal effect on the mean air temperature field and both the mean and peak humidity fields. The maximum temperature will be affected to some extent, the area involved, however, will be rather small (subareas A and B of the area analysed). The mean and maximum yearly times of shading [hr/year] will be comparable to the current situation. The shading time attains its maximum for a few (tens of) days at most, and then in the central subarea only (i.e. within 5 km from NPP Temelín).

The proposed and evaluated model alternatives of the new cooling tower system are basically equivalent with respect to the impacts on the parameters assessed. In a more detailed comparison of the model alternatives, the lowest impact of the plume on ground air temperature and humidity is obtained in model alternative 3 (1700 MW_e output power). Model alternatives 1 and 2 (1200 MW_e output power) are basically equivalent. On the contrary, the time of shading by the plume is longest in model alternative 3 while model alternatives 1 and 2 are basically equivalent once again.

Mean ground air temperature changes in the examined area

The table below shows the mean temperature change increments relative to the current state (i.e. to model alternative 0). The minimum (min), maximum (max) and mean levels are given for each alternative.

Table D.I.28: Mean ground air temperature changes [°C] in the examined area

Altern.	Min.	Max.	Mean
1	0.002	0.09	0.007
2	0.003	0.09	0.008
3	0.002	0.05	0.007

The data demonstrates that the increase in the maximum and mean temperatures is in the order of 10^{-2}°C and 10^{-3}°C, respectively, in all the 3 model alternatives. Although highest in model alternative 2, the increments are below detectable values.

Maximum changes in daily ground air temperature

The table below shows the changes in the daily ground air temperature relative to the current state (i.e. to model alternative 0). The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.29: Maximum changes in the daily ground air temperature [°C]

Altern.	Min.	Max.	Mean
1	0.03	0.88	0.121
2	0.03	0.86	0.124
3	0.03	0.71	0.115

The table also demonstrates that the increments are largest in model alternative 2. The differences between the model alternatives are in the order of 10^{-1}°C, i.e. at the limit of determination.

Mean changes in absolute ground air humidity in the examined area

The table below shows the changes in absolute ground air humidity relative to the current state (i.e. to model alternative 0). The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.30: Mean changes in absolute humidity of ground air [10^{-6} kg.m^{-3}] in the examined area

Altern.	Min.	Max.	Mean
1	0.23	9.09	0.67
2	0.23	8.42	0.69
3	0.04	5.24	0.65

The table demonstrates that the highest maxima of the mean level are attained in model alternative 1 and the highest mean level over the entire area are attained in model alternative 2. The differences between the 2 model alternatives, though, are practically negligible. Of the 3 model alternatives, alternative 3 provides the lowest changes and increments.

Maximum changes in daily absolute ground air humidity

The table below shows the changes in the daily absolute humidity of ground air [%] relative to the current state (i.e. to model alternative 0). The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.31: Maximum changes in daily absolute ground air humidity [10^{-6} kg.m^{-3}]

Altern.	Min.	Max.	Mean
1	3.7	107.9	12.3
2	3.4	103.5	12.6
3	3.4	96.4	11.6

The table demonstrates that the highest maxima are very low - in the order of 10^{-4} kg/m^3 (0.1 g/m^3). The highest maximum and mean levels are obtained from model alternative 2.

Mean changes in relative ground air humidity in the examined area

It follows from the results of the study cited that the effect of the temperature increase predominates over the effect of the absolute humidity increase, so the relative humidity levels exhibit a very small decrease, at tenths of percent, and hence are practically non-measurable.

Mean yearly time of shading by the plume within the examined area

The table below shows the increase in shading relative to the current state (i.e. to model alternative 0). The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.32: Mean yearly time of shading [hr/yr] by the plume within the examined area

Altern.	Min.	Max.	Mean
1	-260	959	0.13
2	-261	997	0.18
3	-260	1,156	0.23

Hence, the patterns for the 3 alternatives are different from those observed for the ground air temperature and humidity. The highest shading maxima and mean values are provided by model alternative 3, whereas model alternatives 1 and 2 provide slightly lower values.

Number of days during which a given change in temperature, in humidity or in shading is exceeded

As regards *change in the daily ground air temperature*, graphical outputs of the study cited show that the number of days higher than 1 (during which change in daily ground air temperature relative to the reference value exceeded the threshold level) is limited to the area close to the NPP Temelín site. For threshold levels above 0.5°C and 0.7°C in model alternatives 0 and 2, respectively, there is less than 1 day annually with an above-the-threshold daily temperature within the entire area.

As regards *humidity change*, the graphical outputs of the study show instances of exceeding the thresholds of 5.0.10^{-6} kg/m^3 in model alternative 0 and of 5.0.10^{-6} and 7.5.10^{-6} kg/m^3 in model alternative 2. Higher threshold values over the entire area were exceeded during a mean number of days lower than 1 in a year.

The mean number of days in a year during which shading occurred for a time longer than the threshold number of hours was calculated for all model alternatives and for threshold values of 1, 2, 3, 4, 5, 6, 8, 10 and 12 hours in a day. Shading for a time longer than 8 hours was found in 2 calculation points located nearest to the towers. The values were 30 and 6 days, respectively. Shading longer than 10 hours (11.66 days) was found in 1 point. Shading for a period exceeding the lowest threshold of 1 hour were found during 204 days in model alternative 0 and during 205 days in model alternative 3. Those data were obtained in the grid nearest to the system of 4 existing towers in model alternative 0 and nearest to the 4 new towers in model alternative 3. In the latter alternative, the maximum number of days with shading longer than 1 hour in a day was attained during 199 days at the site of the system of 4 existing towers.

In conclusion, extreme shading occurs during a significant number of days, this, however, only affects areas in a close vicinity to the system of towers.

Dependence of the parameters on the distance from NPP Temelín

Mean temperature and humidity change parameters are generally very low, and so the decrease towards the periphery is not very marked. For the parameters of the maximum change in the daily temperature and humidity, the decrease is more marked, the average values of the maxima decrease appreciably and a decrease of order of magnitude is also observed for the absolute maxima of the deviations. The model results do not indicate an increase with increasing distance from the towers for any of the parameters tabulated.

Differences between the 3 model alternatives are not very marked. As regards the parameters of ground air temperature and humidity changes, the lowest changes are found in alternative 3. The differences between model alternatives 1 and 2 are small. The effect of the plume is somewhat higher in alternative 2. The shading parameters are lower in model alternatives 1 and 2 than in model alternative 3, the last-mentioned thus being the least favourable alternative from the shading aspect. The above conclusions are formal only because the differences in the periods of shading by the visible plume between the alternatives are minimal.

Indication of precipitation, fog and ice coating in the examined area

The model did not indicate precipitation hitting the ground in any of the model alternatives. Water precipitating from the plume always evaporated before reaching the ground.

None of the model alternatives indicates any fog increase above the occurrence at the site. No increase in the conditions for the formation of icing was identified either.

PLANT (UNITS 1+2+3+4)

The above assessment for the NNPP cooling tower system is completed here with the existing NPP Temelín cooling tower system (model alternative 0).

In addition, the effect of the technical concept of 1 cooling tower per reactor unit (2x1200 MW_e output power only) was assessed. This effect is identical with that of the technical concept of 2 cooling towers per reactor unit within the precision of the model calculation. The data reported here are thus sufficiently representative of the technical concept of 1 cooling tower per unit.

Mean ground air temperature changes in the examined area

The mean changes in the daily temperature are given in the table below. The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.33: Mean ground air temperature changes [°C] in the examined area

Altern.	Min.	Max.	Mean
0	0.003	0.09	0.007
1	0.006	0.18	0.015
2	0.006	0.18	0.016
3	0.006	0.14	0.015

The differences between the model alternatives are in the order of 10^{-2}°C (maxima) and 10^{-3}°C (mean levels). Those are values below the measurable limit.

Maximum changes in daily ground air temperature

The maximum changes in daily temperature [°C] are given in the table below. The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.34: Maximum changes in daily ground air temperature [°C]

Altern.	Min.	Max.	Mean
0	0.04	1.02	0.113
1	0.06	1.36	0.209
2	0.07	1.40	0.213
3	0.07	1.24	0.204

The differences between the model alternatives are in the order of 10^{-1}°C (maxima) and 10^{-2}°C (mean levels). Those are values below the measurable limit.

Mean changes in absolute ground air humidity in the examined area

The mean changes in absolute ground air humidity are given in the table below. The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.35: Mean changes in absolute ground air humidity [10^{-6} kg.m^{-3}] in the examined area

Altern.	Min.	Max.	Mean
0	0.32	9.37	0.81
1	0.56	18.47	1.48
2	0.58	17.79	1.51
3	0.59	14.61	1.46

The table demonstrates that the highest maxima of the mean level are attained in model alternative 1 and the highest mean level over the entire area are attained in model alternative 2. The differences between the 2 model alternatives, though, are practically negligible. Of the 3 model alternatives, alternative 3 provides the lowest changes and increments.

Maximum changes in daily absolute ground air humidity

The maximum changes in absolute ground air humidity [°C] are given in the table below. The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.36: Maximum changes in daily absolute ground air humidity [10^{-6} kg.m^{-3}]

Altern.	Min.	Max.	Mean
0	3.7	146.0	13.2
1	6.9	164.2	22.3
2	7.1	167.1	22.8
3	6.5	145.6	22.0

The table demonstrates that even the highest maxima are very low – in the order of 10^{-4} kg/m^3 (0.1 g/m^3). The highest maximum as well as mean data are obtained from model alternative 2. From among the 3 model alternatives of 8 towers, the lowest values are obtained from model alternative 3.

Mean changes in relative ground air humidity in the examined area

The mean changes in relative ground air humidity [%] are given in the table below. The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.37: Mean changes in relative ground air humidity in the examined area

Altern.	Min.	Max.	Mean
0	-0.51	-0.22	-0.248
1	-0.88	-0.22	-0.279
2	-0.85	-0.22	-0.279
3	-0.74	-0.22	-0.277

The table demonstrates that the effect of the temperature increase predominates over the effect of the absolute humidity increase, so the relative humidity levels exhibit a very small decrease, at tenths of percent, and hence are practically non-measurable. The increase relative to model alternative 0 is negligible.

Mean yearly time of shading by the plume within the examined area

The shading period data are given in the table below. The minimum (min.), maximum (max.) and mean levels are given for each alternative:

Table D.I.38: Mean yearly time of shading [hr/yr] by the plume within the examined area

Altern.	Min.	Max.	Mean
0	0	1,074	0.65
1	0	983	0.79
2	0	1,021	0.83
3	0	1,180	0.88

The table contains global shading parameters over the entire area. The model calculation shows that the maximum number of hours of shading is about 1,000 annually, which can be converted to roughly 80 days when considering the maximum time of shading of 12 h per day. The times of shading are highest in the tower system area, where shading can be expected always when the height of the Sun above the horizon and cloudiness permit so. The calculation bears out a limited extent of the shaded area through a low value of mean shading over all points in the area.

Dependence of the parameters on the distance from NPP Temelín

Mean temperature and humidity change parameters are generally very low, and so the decrease towards the periphery is not very marked. For the parameters of the maximum change in the daily temperature and humidity, the decrease is more marked, the average values of the maxima decrease appreciably, and a decrease at the level of an order of magnitude is also observed for the absolute maxima of the deviations. The model results do not indicate an increase in any of the parameters tabulated with increasing distance from the towers.

The differences between the 3 model variants, 1 through 3, are not very marked. As regards the parameters of ground air temperature and humidity changes, the lowest changes are obtained from alternative 3. The differences between model alternatives 1 and 2 are small. The effect of the plume is somewhat higher in alternative 2. The shading parameters are lower in model alternatives 1 and 2 than in model alternative 3, the last-mentioned alternative thus being the least favourable from the shading aspect. The above conclusions are formal only because the differences in the periods of shading by the visible plume between the 3 model alternatives are minimal.

Indication of precipitation, fog and ice coating in the examined area

The model did not indicate precipitation hitting the ground in any of the model alternatives. Water precipitating from the plume always evaporated before reaching the ground.

None of the model alternatives found any fog increase exceeding normal occurrence at the site. No increase in the conditions for the formation of icing was identified either.

D.I.2.3. Effects during the preparation and construction periods

Dispersion studies have been performed to assess the impacts of the building and construction work, dealing with (i) the impacts of construction work at the construction site and in the areas serving the construction site facilities (dust due to the construction work and operation of the building machines) and (ii) the impacts of traffic related to the construction activities.

The results of the dispersion studies assessing the impacts of construction activities at the construction site and in the areas serving the construction site facilities form the basis for the levels of the contributions as given below.

Table D.I.39: Highest identified contributions [μg.m^{-3}] from construction activities at the construction site and in the areas serving the construction site facilities

	CO	NO_2		PM_{10}	
	8-hr peak	Yearly average [1]	Hourly peak	Yearly average [2]	24-hr peak
Maximum	1030	4.02	17	15.035	35
Limit	10,000	40	200	40	50

[1] The table contains contributions from the sources evaluated only. Current background level of air pollution with NO_2 is 15 μg.m^{-3}.
[2] The table contains contributions from the sources evaluated only. Current background PM_{10} concentration is 4 μg.m^{-3}.

Dust (PM_{10}) concentration in air, including background air pollution and resuspension, does not exceed 20 μg.m^{-3} in the nearby residential areas. Hence, excavation and construction work will not cause air pollution in the NNPP surroundings to exceed the annual limit. Excavation and construction work may bring about an increase in the number of days during which the daily air pollution limit for PM_{10} is exceeded in residential areas around the construction site, by no more than 1 day. The value of the 36th highest PM_{10} concentration in the NNPP surroundings does not exceed 30 μg.m^{-3}. This implies that the limit of 50 μg.m^{-3} imposed on the daily concentrations will not be exceeded in the NNPP surroundings. The above increase in the number of days during which the air pollution limit is exceeded is low enough for the total number of such days to remain within the annual limit of 35.

The effect of traffic associated with the construction phase has been assessed by a separate dispersion study. The conclusions are as follows:

Nitrogen dioxide (NO_2) present in the air of nearby residential areas from total traffic (background included) attains its annual average maxima in some points at Týn nad Vltavou and Zvěrkovice, 10-12 $\mu g.m^{-3}$. This is substantially less than the regulatory limit (40 $\mu g.m^{-3}$). Short-time limits are seldom exceeded (0 to 3 times in a calendar year) in the residential areas. Hence, the NO_2 concentrations from road traffic are acceptable.

Dust in air (PM_{10}) from total traffic (background included) attains the highest annual concentrations of 26-28 $\mu g.m^{-3}$, well below the regulatory limit (40 $\mu g.m^{-3}$). The short-time (24-hr) peaks are described in terms of the expected number of times the regulatory limit is exceeded during a calendar year. This figure is 18-24 in the most burdened direction, well below the limit of 35 cases in a year.

Carbon monoxide (CO) reaches calculated 8-hour mean levels of 2,000-2,500 $\mu g.m^{-3}$, i.e. 20 to 25% of the regulatory limit (10,000 $\mu g.m^{-3}$), in the most exposed direction.

Benzene is evaluated in annual averages only. When compared to the regulatory limit (5 $\mu g.m^{-3}$) the situation is satisfactory: concentrations below 0.8-1.0 $\mu g.m^{-3}$ (background included), i.e. 25% of the limit, are obtained for the most burdened route at Týn nad Vltavou.

Benzo[a]pyrene will be present in the most burdened direction at concentrations up to 0.23 $ng.m^{-3}$, hence, up to 25% of the regulatory limit (1 $ng.m^{-3}$).

D.I.2.4. Impacts during the shutdown period

The impacts on the air during the shutdown period (dismounting and demolition work) are not expected to exceed those acting during the preparation and operation of the installation. The above impacts will be eliminated when the installation is shut down.

D.I.3. Impacts on noise conditions and other physical and biological characteristics

D.I.3.1. Impacts of noise

D.I.3.1.1. Noise from technology

2. PROJECT (UNITS 3+4)

Noise from the operation of the plant technology is analysed for the power plant as a whole after extension, i.e. for units 1+2+3+4.

PLANT (UNITS 1+2+3+4)

The power plant's noise impacts will be determined by the installation of the new power source. Hence, from this point of view the project represents an extension of the existing operation. In other words, the existing power plant will be extended with new buildings associated with the operation of the 2 new reactor units.

In relation to the new reactor units, the existing 400 kV and 110 kV parts of the Kočín switchyard will be extended as well. Although this is another investor's (ČEPS, a.s.) project, the noise impacts are included in the model.

The results of modelling the expected noise situation within the area are given in the table below.

Table D.I.40: Results of modelling noise arising from normal operation of the technology within the plant area - future situation

Point	Description	Equivalent noise level L_{AEq} [dB]

		3 m level	6 m level	12 m level
MB01	Litoradice, periphery - point from which NPP Temelín is directly visible	28.9 ± 4.4	29.8 ± 4.4	30.1 ± 4.4
MB02	Former homestead behind the former village of Knín	30.5 ± 4.4	33.6 ± 4.4	35.3 ± 4.4
MB03	Kočín, northeastern periphery	38.1 ± 4.4	39.5 ± 4.4	40.2 ± 4.4
MB04	Kočín, northeastern periphery - point where noise from the switchyard can be heard	38.9 ± 4.4	39.6 ± 4.4	40.4 ± 4.4
MB05	Kočín, southwestern periphery - point impacted by noise from the switchyard	38.3 ± 4.4	39.7 ± 4.4	40.5 ± 4.4
MB06	Malešice, periphery	31.9 ± 4.4	33.1 ± 4.4	34.3 ± 4.4
MB07	Sedlec, periphery	31.9 ± 4.4	33.2 ± 4.4	33.4 ± 4.4
MB08	Temelín, periphery	42.9 ± 4.4	43.3 ± 4.4	43.4 ± 4.4

Note: For point locations refer to Chapter C.2.3, Noise and other physical and biological characteristics (this document page 257).The figures in red indicate that additional provisions will be necessary because the public health limit for night time operation may be exceeded.

The above figures refer to the potentially noisiest power alternative, i.e. 2x1700 MW_e (with 2 Iterson type cooling towers per reactor unit). For the 2x1200 MW_e power alternative (with 2 or 1 Iterson type cooling tower per reactor unit) the expected noise levels are lower, the difference, however, is not very marked (up to -0.5 dB in calculation points MB01 to MB07 and up to -1.2 dB in calculation point MB08).

Since the noise level at Kočín and at the periphery of Temelín, in front of the protected residential area, may exceed the night time limit, implementation of acoustic provisions at the new cooling towers and at the Kočín switchyard transformers is recommended. Noise abatement provisions at the Kočín substation should also mitigate the current situation where excessive noise has also been confirmed by measurement. For the remaining calculation points the noise burden is nearly identical with that produced by NPP Temelín. The noise study (see annexes hereto) gives evidence that implementation of the noise abatement provisions is feasible.

The above data indicate that feasible technical provisions exist to reduce noise in the nearest NPP Temelín surroundings and in the nearest villages/towns to below regulatory limits (Government Decree no. 148/2006 Coll., on health protection from adverse impacts of noise and vibrations) for protected outdoor areas and for protected outdoor space of buildings during the day and at night, as demonstrated by the table below.

Table D.I.41: Results of modelling noise arising from normal operation of technology within the plant area - future situation with noise abatement provisions

Point	Description	Equivalent noise level L_{AEq} [dB]		
		Level 3 m	Level 6 m	Level 12 m
MB01	Litoradice, periphery - point from which NPP Temelín is directly visible	28.9 ± 4.4	29.8 ± 4.4	30.1 ± 4.4
MB02	Former homestead behind the former village of Knín	30.4 ± 4.4	33.5 ± 4.4	35.2 ± 4.4
MB03	Kočín, northeastern periphery	37.9 ± 4.4	39.1 ± 4.4	39.7 ± 4.4
MB04	Kočín, northeastern periphery - point where noise from the switchyard can be heard	38.6 ± 4.4	39.2 ± 4.4	39.9 ± 4.4
MB05	Kočín, southwestern periphery - point impacted by noise from the switchyard	36.9 ± 4.4	37.9 ± 4.4	38.7 ± 4.4
MB06	Malešice, periphery	31.9 ± 4.4	33.1 ± 4.4	34.3 ± 4.4
MB07	Sedlec, periphery	31.3 ± 4.4	32.4 ± 4.4	33.0 ± 4.4
MB08	Temelín, periphery	37.6 ± 4.4	37.8 ± 4.4	38.1 ± 4.4

D.I.3.1.2. Noise from traffic

2. PROJECT (UNITS 3+4)

A comparison of the current and expected noise levels without and with the new reactor units is given in the table below (for an overview of the points refer to Section C.2.3, Noise and other physical and biological characteristics (this document, page 257).

Table D.I.42: Results of noise calculation at roads impacted by plant operation

Point	Floor	Background, 2005	Future situation in 2015 without the new units	Future situation in 2015 with the new units	Difference 2015-2005 without the new units	Difference 2015-2005 with the new units

		Daytime	Night time	Daytime	Night time	Daytime	Night time	Daytime	Night time	Daytime	Night time
ALBR 1	1	59.1	52.1	59.4	52.1	59.5	52.2	0.3	0.0	0.1	0.1
	2	59.1	52.1	59.4	52.1	59.5	52.2	0.3	0.0	0.1	0.1
ALBR 2	1	64.0	56.8	64.4	57.6	64.4	57.6	0.4	0.8	0.0	0.0
	2	63.9	56.7	64.3	57.5	64.3	57.5	0.4	0.8	0.0	0.0
ALBR 3	1	66.7	59.6	67.2	59.8	67.2	59.8	0.5	0.1	0.0	0.0
	2	66.4	59.3	66.9	59.5	66.9	59.5	0.5	0.2	0.0	0.0
ALBR 4	1	65.9	58.9	66.4	58.9	66.5	59.0	0.5	0.0	0.0	0.0
	2	65.6	58.5	66.1	58.6	66.1	58.6	0.5	0.0	0.0	0.0
ALBR 5	1	66.5	59.5	67.0	59.5	67.1	59.6	0.5	0.0	0.0	0.0
	2	66.0	58.9	66.4	58.9	66.5	59.0	0.5	0.0	0.0	0.0
BREZ 1	1	65.3	58.2	65.8	58.7	65.9	58.7	0.4	0.5	0.1	0.0
	2	66.2	59.0	66.6	59.5	66.7	59.5	0.4	0.5	0.1	0.0
BREZ 2	1	68.4	61.3	68.9	61.8	69.0	61.8	0.4	0.5	0.1	0.0
	2	68.3	61.1	68.7	61.6	68.8	61.7	0.4	0.5	0.1	0.0
BREZ 3	1	70.1	63.0	70.5	63.5	70.6	63.5	0.4	0.5	0.1	0.0
	2	69.4	62.3	69.8	62.7	69.9	62.8	0.4	0.5	0.1	0.0
HLUB 1	1	69.1	62.1	69.5	62.3	69.8	62.6	0.4	0.2	0.3	0.3
	2	69.2	62.1	69.5	62.3	69.8	62.7	0.4	0.2	0.3	0.3
HLUB 2	1	63.6	56.5	64.0	56.7	64.2	57.1	0.4	0.2	0.3	0.3
	2	65.1	58.0	65.4	58.2	65.7	58.6	0.4	0.2	0.3	0.3
NVES 1	1	60.3	53.0	60.8	53.4	61.0	53.9	0.5	0.3	0.3	0.6
	2	60.3	53.0	60.8	53.4	61.0	54.0	0.5	0.3	0.3	0.6
TEM 1	1	58.6	51.0	59.4	51.8	59.4	51.8	0.8	0.7	0.0	0.0
	2	58.2	50.7	59.0	51.4	59.0	51.4	0.8	0.7	0.0	0.0
TEM 2	1	61.5	54.5	61.9	54.8	62.0	54.8	0.4	0.3	0.0	0.0
	2	61.5	54.5	61.9	54.7	61.9	54.7	0.4	0.3	0.0	0.0
TEM 3	1	62.6	56.9	62.9	56.9	63.0	56.9	0.3	0.0	0.1	0.0
	2	62.5	56.8	62.8	56.8	62.9	56.8	0.3	0.0	0.1	0.0
TEM 4	1	63.0	57.2	63.3	57.3	63.3	57.3	0.3	0.0	0.1	0.0
	2	62.8	57.0	63.1	57.1	63.1	57.1	0.3	0.0	0.1	0.0
TEM 5	1	63.8	57.5	64.1	57.5	64.2	57.5	0.3	0.0	0.0	0.0
	2	64.1	57.9	64.5	57.9	64.5	57.9	0.3	0.0	0.0	0.0
TEM 6	1	56.4	49.8	56.9	49.8	57.0	49.9	0.5	0.0	0.2	0.1
	2	56.5	50.0	57.0	50.0	57.2	50.1	0.5	0.0	0.2	0.1
TEM 7	1	59.4	52.8	59.9	52.8	60.1	52.9	0.5	0.0	0.2	0.1
	2	59.3	52.7	59.8	52.7	60.0	52.8	0.5	0.0	0.2	0.1
TYN 1	1	63.8	56.5	64.1	56.9	64.3	57.1	0.4	0.3	0.1	0.2
	2	64.0	56.8	64.4	57.1	64.5	57.3	0.4	0.3	0.1	0.2
TYN 2	1	58.1	50.8	58.4	51.2	58.6	51.4	0.4	0.3	0.1	0.2
	2	58.1	50.9	58.5	51.2	58.6	51.4	0.4	0.3	0.1	0.2
	3	58.2	51.0	58.6	51.3	58.7	51.6	0.4	0.3	0.1	0.2
	4	58.3	51.1	58.7	51.4	58.8	51.6	0.4	0.3	0.1	0.2
	5	58.5	51.2	58.8	51.6	59.0	51.8	0.4	0.3	0.1	0.2
	6	58.6	51.4	59.0	51.7	59.1	52.0	0.4	0.3	0.1	0.2
TYN 3	1	60.8	53.6	61.2	53.9	61.3	54.1	0.4	0.3	0.1	0.2
	2	60.8	53.6	61.2	53.9	61.3	54.2	0.4	0.3	0.1	0.2
	3	60.8	53.6	61.2	53.9	61.3	54.1	0.4	0.3	0.1	0.2
	4	60.8	53.6	61.1	53.9	61.3	54.1	0.4	0.3	0.1	0.2
	5	60.7	53.5	61.1	53.8	61.2	54.1	0.4	0.3	0.1	0.2
	6	60.7	53.4	61.0	53.8	61.2	54.0	0.4	0.3	0.1	0.2
TYN 4	1	62.8	55.7	63.2	55.9	63.3	56.0	0.4	0.2	0.1	0.1
	2	62.9	55.8	63.3	56.0	63.4	56.1	0.4	0.2	0.1	0.1
TYN 5	1	59.9	52.7	60.3	53.2	60.4	53.3	0.4	0.5	0.1	0.0
	2	60.1	53.0	60.6	53.5	60.7	53.5	0.4	0.5	0.1	0.0
TYN 6	1	59.8	52.7	60.2	53.2	60.3	53.2	0.4	0.5	0.1	0.0
	2	61.4	54.3	61.8	54.8	61.9	54.8	0.4	0.5	0.1	0.0
VSET 1	1	53.2	46.6	53.7	46.6	53.9	46.7	0.5	0.0	0.2	0.1
	2	52.6	46.0	53.1	46.0	53.3	46.2	0.5	0.0	0.2	0.1
VSET 2	1	58.3	51.8	58.8	51.8	59.0	51.9	0.5	0.0	0.2	0.1
	2	59.0	52.4	59.5	52.4	59.7	52.6	0.5	0.0	0.2	0.1
VSET 3	1	56.1	49.1	56.4	49.1	56.5	49.2	0.3	0.0	0.1	0.1
	2	56.1	49.1	56.4	49.1	56.5	49.2	0.3	0.0	0.1	0.1
ZVER 1	1	61.3	54.0	61.8	54.4	61.9	54.8	0.5	0.4	0.1	0.4
	2	61.5	54.2	61.9	54.6	62.1	54.9	0.5	0.4	0.1	0.4
ZVER 2	1	65.3	58.0	65.7	58.4	65.9	58.7	0.5	0.4	0.1	0.4
	2	65.3	58.0	65.7	58.4	65.9	58.7	0.5	0.4	0.1	0.4

Note: The figures in red exceed the basic health limits for noise from major roads and streets (Government Decree no. 148/2006 on health protection from adverse impacts of noise and vibrations).

The potential noise increase due to traffic related to the new nuclear installation is calculated to be 0 to 0.3 dB during the day and 0 to 0.6 dB at night. Such increments are immeasurable/undetectable in practice, falling in the uncertainty of measurement, and will not be perceived by humans. They can be regarded as insignificant (according to the methodology issued by the National Reference Laboratory for Municipal Noise Measurement and Assessment on 11 September 2008 and approved by the Chief Public Health Officer of the Czech Republic, a noise level change lying within the range of 0.1-0.9 dB cannot be considered relevant).

Noise from rail transport on track no.192, Číčenice - Týn nad Vltavou, including the NPP Temelín siding, does not increase the noise level in the village of Temelín to above the daytime and night time regulatory limits. This will also be true after the new reactor units are made operable.

In view of an insignificant noise increment in the calculation points due to the operation of the new reactor units, no provisions are proposed to abate noise caused specifically by traffic serving the new nuclear installation.

PLANT (UNITS 1+2+3+4)

The same applies to the power plant after expansion. In view of the minimal noise increase in the calculation points due to road traffic serving the extended plant operation, no specific noise abatement provisions are proposed. Health protection against excessive noise from public roads (Act no. 258/2000 on public health protection, as amended) is the responsibility of the road owner/administrator. If such provisions are implemented, they will be, of course, also efficient in road traffic serving the operation of the new reactor units, whose contribution to the noise levels is minor.

D.I.3.2. Effects of vibration

PROJECT (UNITS 3+4)

The new nuclear installation will produce no vibrations observable beyond the plant or NPP Temelín area itself. Requirements stipulated by applicable legislation and rules for health protection from vibrations will be safely complied with.

PLANT (UNITS 1+2+3+4)

The above conclusions also apply to the plant as a whole after expansion.

D.I.3.3. Effects of ionising radiation

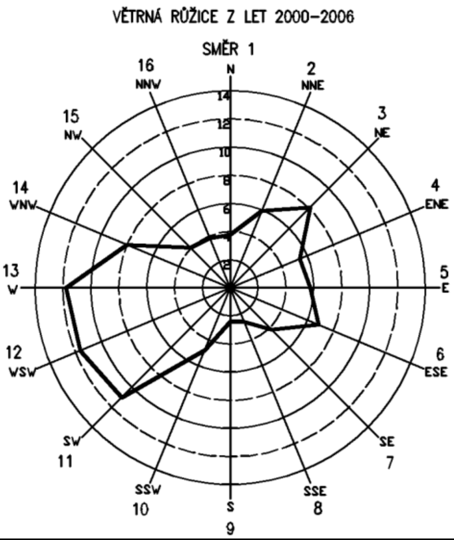
D.I.3.3.1. Effect of radioactive atmospheric discharges

Radiological impacts of normal operation of the 2 new reactor units plus the existing 2 NPP Temelín reactor units were assessed by using the NORMAL version 02 code, approved for use by the State Office for Nuclear Safety's Assessment Committee no. 6.

For the sake of calculation of the new installation's radiological impacts, the plant surroundings were divided into 16 directions and 20 distance zones. The code takes into account altitude, ground roughness and land-use type (grass, field, forest, watercourse/water area, residential buildings) at the Temelín site. Conservative assumptions were used in the calculation of the specific ground air radioactivity levels, deposition of the ground and deposition dose rates (resulting from the long-term weighted factors of dry and wet fallout). Weather data are based on the situation in 2000-2006.

The highest annual dose was obtained for direction 3 (the northeastern direction), to which the results presented below are related.

Figure D.I.1: Wind rose with sectors and cardinal points marked



VĚTRNÁ RŮŽICE Z LET 2000 - 2006	WIND PATTERNS 2000-2006
SMĚR	DIRECTION

PROJECT (UNITS 3+4)

2×1200 MW_e power alternative

Table D.I.43: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units, approximately 1200 MW_e ouput power each (2020) - adults

Distance	Dose from the cloud	Dose from the deposit	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.43E-06	3.29E-08	1.53E-07	2.86E-07	2.66E-11	1.90E-06
1,333	4.09E-07	1.82E-08	1.29E-07	2.00E-07	1.58E-11	7.56E-07
2,333	2.45E-07	1.20E-08	9.37E-08	1.49E-07	9.91E-12	4.99E-07
3,333	1.44E-07	8.78E-09	6.84E-08	1.08E-07	7.57E-12	3.29E-07
4,333	9.75E-08	8.89E-09	5.34E-08	9.24E-08	7.97E-12	2.52E-07
5,333	7.17E-08	4.32E-09	4.43E-08	6.49E-08	3.57E-12	1.85E-07
6,333	5.56E-08	3.99E-09	3.83E-08	5.72E-08	3.38E-12	1.55E-07
7,333	4.48E-08	3.27E-09	3.40E-08	4.98E-08	2.78E-12	1.32E-07
8,667	3.50E-08	2.86E-09	2.98E-08	4.37E-08	2.46E-12	1.11E-07
10,667	2.58E-08	3.90E-09	2.52E-08	4.27E-08	3.49E-12	9.76E-08
12,667	2.01E-08	1.66E-09	2.19E-08	3.06E-08	1.39E-12	7.43E-08
14,667	1.62E-08	2.66E-09	1.94E-08	3.15E-08	2.29E-12	6.97E-08
17,333	1.27E-08	2.67E-09	1.67E-08	2.83E-08	2.18E-12	6.04E-08
21,667	1.02E-08	1.73E-09	1.77E-08	2.58E-08	1.24E-12	5.54E-08

Table D.I.44: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units approximately 1200 MW_e ouput power each (2020) - children aged 0-1

Distance	Dose from the cloud	Dose from the deposit	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.43E-06	3.29E-08	7.05E-08	3.20E-07	2.32E-11	1.85E-06

1,333	4.09E-07	1.82E-08	5.96E-08	2.28E-07	1.39E-11	7.15E-07
2,333	2.45E-07	1.20E-08	4.30E-08	1.68E-07	8.69E-12	4.68E-07
3,333	1.44E-07	8.78E-09	3.14E-08	1.24E-07	6.66E-12	3.08E-07
4,333	9.75E-08	8.89E-09	2.45E-08	1.05E-07	7.04E-12	2.36E-07
5,333	7.17E-08	4.32E-09	2.03E-08	7.52E-08	3.12E-12	1.71E-07
6,333	5.56E-08	3.99E-09	1.75E-08	6.61E-08	2.97E-12	1.43E-07
7,333	4.48E-08	3.27E-09	1.55E-08	5.77E-08	2.44E-12	1.21E-07
8,667	3.50E-08	2.86E-09	1.36E-08	5.07E-08	2.16E-12	1.02E-07
10,667	2.58E-08	3.90E-09	1.15E-08	4.86E-08	3.08E-12	8.98E-08
12,667	2.01E-08	1.66E-09	9.99E-09	3.58E-08	1.21E-12	6.75E-08
14,667	1.62E-08	2.66E-09	8.80E-09	3.60E-08	2.01E-12	6.37E-08
17,333	1.27E-08	2.67E-09	7.57E-09	3.21E-08	1.90E-12	5.51E-08
21,667	1.02E-08	1.73E-09	7.95E-09	2.99E-08	1.07E-12	4.97E-08

Table D.I.45: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units approximately 1200 MW_e ouput power each (2020) - children aged 1-2

Distance	Dose from the cloud	Dose from the deposit	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.43E-06	3.29E-08	2.07E-07	1.28E-06	7.45E-11	2.95E-06
1,333	4.09E-07	1.82E-08	1.74E-07	8.40E-07	4.45E-11	1.44E-06
2,333	2.45E-07	1.20E-08	1.26E-07	5.76E-07	2.78E-11	9.59E-07
3,333	1.44E-07	8.78E-09	9.19E-08	4.32E-07	2.13E-11	6.77E-07
4,333	9.75E-08	8.89E-09	7.17E-08	4.07E-07	2.26E-11	5.85E-07
5,333	7.17E-08	4.32E-09	5.94E-08	2.35E-07	1.00E-11	3.70E-07
6,333	5.56E-08	3.99E-09	5.12E-08	2.14E-07	9.52E-12	3.24E-07
7,333	4.48E-08	3.27E-09	4.55E-08	1.82E-07	7.82E-12	2.76E-07
8,667	3.50E-08	2.86E-09	3.98E-08	1.60E-07	6.92E-12	2.38E-07
10,667	2.58E-08	3.90E-09	3.36E-08	1.83E-07	9.88E-12	2.47E-07
12,667	2.01E-08	1.66E-09	2.92E-08	1.04E-07	3.89E-12	1.55E-07
14,667	1.62E-08	2.66E-09	2.58E-08	1.28E-07	6.46E-12	1.72E-07
17,333	1.27E-08	2.67E-09	2.21E-08	1.17E-07	6.09E-12	1.54E-07
21,667	1.02E-08	1.73E-09	2.32E-08	8.80E-08	3.42E-12	1.23E-07

Table D.I.46: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units approximately 1200 MW_e ouput power each (2020) - children aged 2-7

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.43E-06	3.29E-08	1.30E-07	7.42E-07	4.33E-11	2.34E-06
1,333	4.09E-07	1.82E-08	1.10E-07	4.90E-07	2.58E-11	1.03E-06
2,333	2.45E-07	1.20E-08	7.93E-08	3.38E-07	1.62E-11	6.74E-07
3,333	1.44E-07	8.78E-09	5.78E-08	2.53E-07	1.24E-11	4.63E-07
4,333	9.75E-08	8.89E-09	4.51E-08	2.36E-07	1.31E-11	3.88E-07
5,333	7.17E-08	4.32E-09	3.74E-08	1.39E-07	5.81E-12	2.52E-07
6,333	5.56E-08	3.99E-09	3.23E-08	1.26E-07	5.53E-12	2.18E-07
7,333	4.48E-08	3.27E-09	2.86E-08	1.07E-07	4.54E-12	1.84E-07
8,667	3.50E-08	2.86E-09	2.51E-08	9.47E-08	4.02E-12	1.58E-07
10,667	2.58E-08	3.90E-09	2.12E-08	1.07E-07	5.74E-12	1.58E-07
12,667	2.01E-08	1.66E-09	1.84E-08	6.19E-08	2.26E-12	1.02E-07
14,667	1.62E-08	2.66E-09	1.62E-08	7.47E-08	3.75E-12	1.10E-07
17,333	1.27E-08	2.67E-09	1.40E-08	6.81E-08	3.54E-12	9.74E-08
21,667	1.02E-08	1.73E-09	1.47E-08	5.23E-08	1.99E-12	7.88E-08

Table D.I.47: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units approximately 1200 MW$_e$ ouput power each (2020) - children aged 7-12

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.43E-06	3.29E-08	7.98E-08	5.36E-07	2.23E-11	2.08E-06
1,333	4.09E-07	1.82E-08	6.72E-08	3.63E-07	1.33E-11	8.58E-07
2,333	2.45E-07	1.20E-08	4.87E-08	2.58E-07	8.31E-12	5.64E-07
3,333	1.44E-07	8.78E-09	3.55E-08	1.92E-07	6.36E-12	3.80E-07
4,333	9.75E-08	8.89E-09	2.77E-08	1.72E-07	6.72E-12	3.06E-07
5,333	7.17E-08	4.32E-09	2.30E-08	1.10E-07	2.99E-12	2.09E-07
6,333	5.56E-08	3.99E-09	1.99E-08	9.80E-08	2.84E-12	1.77E-07
7,333	4.48E-08	3.27E-09	1.76E-08	8.45E-08	2.33E-12	1.50E-07
8,667	3.50E-08	2.86E-09	1.54E-08	7.43E-08	2.06E-12	1.28E-07
10,667	2.58E-08	3.90E-09	1.31E-08	7.86E-08	2.94E-12	1.21E-07
12,667	2.01E-08	1.66E-09	1.14E-08	5.03E-08	1.16E-12	8.34E-08
14,667	1.62E-08	2.66E-09	1.00E-08	5.62E-08	1.93E-12	8.51E-08
17,333	1.27E-08	2.67E-09	8.62E-09	5.08E-08	1.82E-12	7.49E-08
21,667	1.02E-08	1.73E-09	9.08E-09	4.23E-08	1.03E-12	6.32E-08

Table D.I.48: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units, approximately 1200 MW$_e$ ouput power each (2020) - children aged 12-17

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.43E-06	3.29E-08	1.23E-07	3.81E-07	2.94E-11	1.97E-06
1,333	4.09E-07	1.82E-08	1.03E-07	2.60E-07	1.75E-11	7.90E-07
2,333	2.45E-07	1.20E-08	7.49E-08	1.87E-07	1.10E-11	5.19E-07
3,333	1.44E-07	8.78E-09	5.46E-08	1.38E-07	8.39E-12	3.45E-07
4,333	9.75E-08	8.89E-09	4.27E-08	1.22E-07	8.85E-12	2.71E-07
5,333	7.17E-08	4.32E-09	3.54E-08	8.01E-08	3.94E-12	1.91E-07
6,333	5.56E-08	3.99E-09	3.05E-08	7.12E-08	3.75E-12	1.61E-07
7,333	4.48E-08	3.27E-09	2.71E-08	6.16E-08	3.08E-12	1.37E-07
8,667	3.50E-08	2.86E-09	2.37E-08	5.41E-08	2.72E-12	1.16E-07
10,667	2.58E-08	3.90E-09	2.01E-08	5.58E-08	3.87E-12	1.06E-07
12,667	2.01E-08	1.66E-09	1.75E-08	3.70E-08	1.53E-12	7.63E-08
14,667	1.62E-08	2.66E-09	1.54E-08	4.04E-08	2.54E-12	7.47E-08
17,333	1.27E-08	2.67E-09	1.33E-08	3.66E-08	2.41E-12	6.53E-08
21,667	1.02E-08	1.73E-09	1.40E-08	3.14E-08	1.37E-12	5.73E-08

Table D.I.49: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1200 MW$_e$ ouput power each (2050) - adults

Distance	Dose from the cloud	Dose from the deposit in the 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	1.43E-06	2.23E-07	1.53E-07	3.01E-07	2.66E-11	2.11E-06	5.25E-06	6.18E-05
1,333	4.09E-07	1.17E-07	1.29E-07	2.08E-07	1.58E-11	8.63E-07	2.75E-06	2.51E-05
2,333	2.45E-07	7.85E-08	9.37E-08	1.54E-07	9.91E-12	5.71E-07	1.86E-06	1.66E-05
3,333	1.44E-07	5.66E-08	6.84E-08	1.12E-07	7.57E-12	3.81E-07	1.34E-06	1.11E-05

4,333	9.75E-08	5.55E-08	5.34E-08	9.62E-08	7.97E-12	3.03E-07	1.31E-06	8.72E-06
5,333	7.17E-08	2.89E-08	4.43E-08	6.69E-08	3.57E-12	2.12E-07	6.81E-07	6.17E-06
6,333	5.56E-08	2.61E-08	3.83E-08	5.90E-08	3.38E-12	1.79E-07	6.14E-07	5.20E-06
7,333	4.48E-08	2.14E-08	3.40E-08	5.13E-08	2.78E-12	1.51E-07	5.05E-07	4.41E-06
8,667	3.50E-08	1.85E-08	2.98E-08	4.50E-08	2.46E-12	1.28E-07	4.37E-07	3.73E-06
10,667	2.58E-08	2.45E-08	2.52E-08	4.44E-08	3.49E-12	1.20E-07	5.78E-07	3.44E-06
12,667	2.01E-08	1.10E-08	2.19E-08	3.14E-08	1.39E-12	8.45E-08	2.60E-07	2.46E-06
14,667	1.62E-08	1.73E-08	1.94E-08	3.26E-08	2.29E-12	8.55E-08	4.07E-07	2.45E-06
17,333	1.27E-08	1.81E-08	1.67E-08	2.96E-08	2.18E-12	7.71E-08	4.26E-07	2.20E-06
21,667	1.02E-08	1.28E-08	1.77E-08	2.67E-08	1.24E-12	6.73E-08	2.99E-07	1.94E-06

Table D.I.50: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1200 MW_e ouput power each (2050) - children aged 0-1

Distance	Dose from the cloud	Dose from the deposit in the 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	1.43E-06	2.23E-07	7.05E-08	3.58E-07	2.32E-11	2.08E-06	5.25E-06	6.10E-05
1,333	4.09E-07	1.17E-07	5.96E-08	2.48E-07	1.39E-11	8.34E-07	2.75E-06	2.43E-05
2,333	2.45E-07	7.85E-08	4.30E-08	1.81E-07	8.69E-12	5.48E-07	1.86E-06	1.59E-05
3,333	1.44E-07	5.66E-08	3.14E-08	1.34E-07	6.66E-12	3.66E-07	1.34E-06	1.06E-05
4,333	9.75E-08	5.55E-08	2.45E-08	1.14E-07	7.04E-12	2.92E-07	1.31E-06	8.40E-06
5,333	7.17E-08	2.89E-08	2.03E-08	8.01E-08	3.12E-12	2.01E-07	6.81E-07	5.84E-06
6,333	5.56E-08	2.61E-08	1.75E-08	7.05E-08	2.97E-12	1.70E-07	6.14E-07	4.92E-06
7,333	4.48E-08	2.14E-08	1.55E-08	6.14E-08	2.44E-12	1.43E-07	5.05E-07	4.16E-06
8,667	3.50E-08	1.85E-08	1.36E-08	5.38E-08	2.16E-12	1.21E-07	4.37E-07	3.51E-06
10,667	2.58E-08	2.45E-08	1.15E-08	5.27E-08	3.08E-12	1.15E-07	5.78E-07	3.28E-06
12,667	2.01E-08	1.10E-08	9.99E-09	3.76E-08	1.21E-12	7.88E-08	2.60E-07	2.29E-06
14,667	1.62E-08	1.73E-08	8.80E-09	3.89E-08	2.01E-12	8.12E-08	4.07E-07	2.32E-06
17,333	1.27E-08	1.81E-08	7.57E-09	3.52E-08	1.90E-12	7.36E-08	4.26E-07	2.09E-06
21,667	1.02E-08	1.28E-08	7.95E-09	3.21E-08	1.07E-12	6.29E-08	2.99E-07	1.80E-06

Table D.I.51: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1200 MW_e ouput power each (2050) - children aged 1-2

Distance	Dose from the cloud	Dose from the deposit in the 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	1.43E-06	2.23E-07	2.07E-07	1.31E-06	7.45E-11	3.17E-06	5.25E-06	9.37E-05
1,333	4.09E-07	1.17E-07	1.74E-07	8.56E-07	4.45E-11	1.56E-06	2.75E-06	4.59E-05
2,333	2.45E-07	7.85E-08	1.26E-07	5.86E-07	2.78E-11	1.04E-06	1.86E-06	3.06E-05
3,333	1.44E-07	5.66E-08	9.19E-08	4.39E-07	2.13E-11	7.32E-07	1.34E-06	2.16E-05
4,333	9.75E-08	5.55E-08	7.17E-08	4.14E-07	2.26E-11	6.39E-07	1.31E-06	1.88E-05
5,333	7.17E-08	2.89E-08	5.94E-08	2.39E-07	1.00E-11	3.99E-07	6.81E-07	1.18E-05
6,333	5.56E-08	2.61E-08	5.12E-08	2.17E-07	9.52E-12	3.50E-07	6.14E-07	1.03E-05
7,333	4.48E-08	2.14E-08	4.55E-08	1.85E-07	7.82E-12	2.97E-07	5.05E-07	8.76E-06
8,667	3.50E-08	1.85E-08	3.98E-08	1.63E-07	6.92E-12	2.56E-07	4.37E-07	7.57E-06
10,667	2.58E-08	2.45E-08	3.36E-08	1.87E-07	9.88E-12	2.71E-07	5.78E-07	7.96E-06
12,667	2.01E-08	1.10E-08	2.92E-08	1.06E-07	3.89E-12	1.66E-07	2.60E-07	4.91E-06
14,667	1.62E-08	1.73E-08	2.58E-08	1.30E-07	6.46E-12	1.89E-07	4.07E-07	5.57E-06
17,333	1.27E-08	1.81E-08	2.21E-08	1.19E-07	6.09E-12	1.72E-07	4.26E-07	5.04E-06
21,667	1.02E-08	1.28E-08	2.32E-08	8.98E-08	3.42E-12	1.36E-07	2.99E-07	3.99E-06

Table D.I.52: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1200 MW_e ouput power each (2050) - children aged 2-7

Distance	Dose from the cloud	Dose from the deposit in the 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	1.43E-06	2.23E-07	1.30E-07	7.62E-07	4.33E-11	2.55E-06	5.25E-06	7.49E-05
1,333	4.09E-07	1.17E-07	1.10E-07	5.00E-07	2.58E-11	1.14E-06	2.75E-06	3.33E-05
2,333	2.45E-07	7.85E-08	7.93E-08	3.44E-07	1.62E-11	7.47E-07	1.86E-06	2.19E-05
3,333	1.44E-07	5.66E-08	5.78E-08	2.58E-07	1.24E-11	5.16E-07	1.34E-06	1.51E-05
4,333	9.75E-08	5.55E-08	4.51E-08	2.41E-07	1.31E-11	4.39E-07	1.31E-06	1.28E-05
5,333	7.17E-08	2.89E-08	3.74E-08	1.41E-07	5.81E-12	2.79E-07	6.81E-07	8.19E-06
6,333	5.56E-08	2.61E-08	3.23E-08	1.28E-07	5.53E-12	2.42E-07	6.14E-07	7.09E-06
7,333	4.48E-08	2.14E-08	2.86E-08	1.09E-07	4.54E-12	2.04E-07	5.05E-07	5.99E-06
8,667	3.50E-08	1.85E-08	2.51E-08	9.63E-08	4.02E-12	1.75E-07	4.37E-07	5.13E-06
10,667	2.58E-08	2.45E-08	2.12E-08	1.09E-07	5.74E-12	1.80E-07	5.78E-07	5.25E-06
12,667	2.01E-08	1.10E-08	1.84E-08	6.29E-08	2.26E-12	1.12E-07	2.60E-07	3.30E-06
14,667	1.62E-08	1.73E-08	1.62E-08	7.62E-08	3.75E-12	1.26E-07	4.07E-07	3.67E-06
17,333	1.27E-08	1.81E-08	1.40E-08	6.96E-08	3.54E-12	1.14E-07	4.26E-07	3.32E-06
21,667	1.02E-08	1.28E-08	1.47E-08	5.34E-08	1.99E-12	9.10E-08	2.99E-07	2.65E-06

Table D.I.53: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1200 MW_e ouput power each (2050) - children aged 7-12

Distance	Dose from the cloud	Dose from the deposit in the 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	1.43E-06	2.23E-07	7.98E-08	5.61E-07	2.23E-11	2.30E-06	5.25E-06	6.74E-05
1,333	4.09E-07	1.17E-07	6.72E-08	3.77E-07	1.33E-11	9.70E-07	2.75E-06	2.84E-05
2,333	2.45E-07	7.85E-08	4.87E-08	2.67E-07	8.31E-12	6.39E-07	1.86E-06	1.87E-05
3,333	1.44E-07	5.66E-08	3.55E-08	1.98E-07	6.36E-12	4.34E-07	1.34E-06	1.27E-05
4,333	9.75E-08	5.55E-08	2.77E-08	1.79E-07	6.72E-12	3.59E-07	1.31E-06	1.04E-05
5,333	7.17E-08	2.89E-08	2.30E-08	1.13E-07	2.99E-12	2.37E-07	6.81E-07	6.91E-06
6,333	5.56E-08	2.61E-08	1.99E-08	1.01E-07	2.84E-12	2.02E-07	6.14E-07	5.91E-06
7,333	4.48E-08	2.14E-08	1.76E-08	8.70E-08	2.33E-12	1.71E-07	5.05E-07	4.99E-06
8,667	3.50E-08	1.85E-08	1.54E-08	7.65E-08	2.06E-12	1.45E-07	4.37E-07	4.24E-06
10,667	2.58E-08	2.45E-08	1.31E-08	8.13E-08	2.94E-12	1.45E-07	5.78E-07	4.18E-06
12,667	2.01E-08	1.10E-08	1.14E-08	5.15E-08	1.16E-12	9.40E-08	2.60E-07	2.75E-06
14,667	1.62E-08	1.73E-08	1.00E-08	5.82E-08	1.93E-12	1.02E-07	4.07E-07	2.94E-06
17,333	1.27E-08	1.81E-08	8.62E-09	5.29E-08	1.82E-12	9.24E-08	4.26E-07	2.65E-06
21,667	1.02E-08	1.28E-08	9.08E-09	4.38E-08	1.03E-12	7.57E-08	2.99E-07	2.19E-06

Table D.I.54: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1200 MW_e ouput power each (2050) - children aged 12-17

Distance	Dose from the cloud	Dose from the deposit in the 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	1.43E-06	2.23E-07	1.23E-07	4.15E-07	2.94E-11	2.19E-06	5.25E-06	6.43E-05
1,333	4.09E-07	1.17E-07	1.03E-07	2.77E-07	1.75E-11	9.06E-07	2.75E-06	2.64E-05
2,333	2.45E-07	7.85E-08	7.49E-08	1.99E-07	1.10E-11	5.98E-07	1.86E-06	1.74E-05
3,333	1.44E-07	5.66E-08	5.46E-08	1.46E-07	8.39E-12	4.02E-07	1.34E-06	1.17E-05
4,333	9.75E-08	5.55E-08	4.27E-08	1.30E-07	8.85E-12	3.26E-07	1.31E-06	9.43E-06
5,333	7.17E-08	2.89E-08	3.54E-08	8.46E-08	3.94E-12	2.21E-07	6.81E-07	6.43E-06
6,333	5.56E-08	2.61E-08	3.05E-08	7.52E-08	3.75E-12	1.87E-07	6.14E-07	5.46E-06
7,333	4.48E-08	2.14E-08	2.71E-08	6.49E-08	3.08E-12	1.58E-07	5.05E-07	4.61E-06
8,667	3.50E-08	1.85E-08	2.37E-08	5.70E-08	2.72E-12	1.34E-07	4.37E-07	3.91E-06
10,667	2.58E-08	2.45E-08	2.01E-08	5.95E-08	3.87E-12	1.30E-07	5.78E-07	3.74E-06
12,667	2.01E-08	1.10E-08	1.75E-08	3.87E-08	1.53E-12	8.73E-08	2.60E-07	2.55E-06
14,667	1.62E-08	1.73E-08	1.54E-08	4.30E-08	2.54E-12	9.19E-08	4.07E-07	2.65E-06
17,333	1.27E-08	1.81E-08	1.33E-08	3.93E-08	2.41E-12	8.35E-08	4.26E-07	2.39E-06
21,667	1.02E-08	1.28E-08	1.40E-08	3.33E-08	1.37E-12	7.03E-08	2.99E-07	2.02E-06

Table D.I.55: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1200 MW_e ouput power each (2080) - adults

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	1.43E-06	2.32E-07	1.53E-07	3.02E-07	2.66E-11	2.12E-06	1.21E-05	1.25E-04
1,333	4.09E-07	1.21E-07	1.29E-07	2.08E-07	1.58E-11	8.68E-07	6.35E-06	5.11E-05
2,333	2.45E-07	8.15E-08	9.37E-08	1.54E-07	9.91E-12	5.75E-07	4.28E-06	3.39E-05
3,333	1.44E-07	5.88E-08	6.84E-08	1.12E-07	7.57E-12	3.83E-07	3.08E-06	2.26E-05
4,333	9.75E-08	5.76E-08	5.34E-08	9.63E-08	7.97E-12	3.05E-07	3.02E-06	1.79E-05
5,333	7.17E-08	3.01E-08	4.43E-08	6.70E-08	3.57E-12	2.13E-07	1.57E-06	1.26E-05
6,333	5.56E-08	2.71E-08	3.83E-08	5.90E-08	3.38E-12	1.80E-07	1.42E-06	1.06E-05
7,333	4.48E-08	2.23E-08	3.40E-08	5.14E-08	2.78E-12	1.52E-07	1.17E-06	8.97E-06
8,667	3.50E-08	1.93E-08	2.98E-08	4.50E-08	2.46E-12	1.29E-07	1.01E-06	7.60E-06
10,667	2.58E-08	2.54E-08	2.52E-08	4.44E-08	3.49E-12	1.21E-07	1.33E-06	7.06E-06
12,667	2.01E-08	1.15E-08	2.19E-08	3.14E-08	1.39E-12	8.49E-08	6.00E-07	5.01E-06
14,667	1.62E-08	1.79E-08	1.94E-08	3.27E-08	2.29E-12	8.62E-08	9.38E-07	5.04E-06
17,333	1.27E-08	1.88E-08	1.67E-08	2.96E-08	2.18E-12	7.79E-08	9.83E-07	4.53E-06
21,667	1.02E-08	1.33E-08	1.77E-08	2.68E-08	1.24E-12	6.79E-08	6.92E-07	3.97E-06

Table D.I.56: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1200 MW$_e$ ouput power each (2080) - children aged 0-1

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	1.43E-06	2.32E-07	7.05E-08	3.59E-07	2.32E-11	2.09E-06	1.21E-05	1.24E-04
1,333	4.09E-07	1.21E-07	5.96E-08	2.49E-07	1.39E-11	8.39E-07	6.35E-06	4.94E-05
2,333	2.45E-07	8.15E-08	4.30E-08	1.82E-07	8.69E-12	5.51E-07	4.28E-06	3.25E-05
3,333	1.44E-07	5.88E-08	3.14E-08	1.34E-07	6.66E-12	3.68E-07	3.08E-06	2.16E-05
4,333	9.75E-08	5.76E-08	2.45E-08	1.15E-07	7.04E-12	2.94E-07	3.02E-06	1.72E-05
5,333	7.17E-08	3.01E-08	2.03E-08	8.03E-08	3.12E-12	2.02E-07	1.57E-06	1.19E-05
6,333	5.56E-08	2.71E-08	1.75E-08	7.07E-08	2.97E-12	1.71E-07	1.42E-06	1.00E-05
7,333	4.48E-08	2.23E-08	1.55E-08	6.15E-08	2.44E-12	1.44E-07	1.17E-06	8.47E-06
8,667	3.50E-08	1.93E-08	1.36E-08	5.39E-08	2.16E-12	1.22E-07	1.01E-06	7.16E-06
10,667	2.58E-08	2.54E-08	1.15E-08	5.29E-08	3.08E-12	1.16E-07	1.33E-06	6.74E-06
12,667	2.01E-08	1.15E-08	9.99E-09	3.77E-08	1.21E-12	7.93E-08	6.00E-07	4.67E-06
14,667	1.62E-08	1.79E-08	8.80E-09	3.90E-08	2.01E-12	8.20E-08	9.38E-07	4.78E-06
17,333	1.27E-08	1.88E-08	7.57E-09	3.53E-08	1.90E-12	7.44E-08	9.83E-07	4.32E-06
21,667	1.02E-08	1.33E-08	7.95E-09	3.22E-08	1.07E-12	6.35E-08	6.92E-07	3.71E-06

Table D.I.57: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1200 MW$_e$ ouput power each (2080) - children aged 1-2

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	1.43E-06	2.32E-07	2.07E-07	1.31E-06	7.45E-11	3.18E-06	1.21E-05	1.89E-04
1,333	4.09E-07	1.21E-07	1.74E-07	8.56E-07	4.45E-11	1.56E-06	6.35E-06	9.27E-05
2,333	2.45E-07	8.15E-08	1.26E-07	5.86E-07	2.78E-11	1.04E-06	4.28E-06	6.17E-05
3,333	1.44E-07	5.88E-08	9.19E-08	4.40E-07	2.13E-11	7.34E-07	3.08E-06	4.36E-05
4,333	9.75E-08	5.76E-08	7.17E-08	4.14E-07	2.26E-11	6.41E-07	3.02E-06	3.80E-05
5,333	7.17E-08	3.01E-08	5.94E-08	2.39E-07	1.00E-11	4.00E-07	1.57E-06	2.38E-05
6,333	5.56E-08	2.71E-08	5.12E-08	2.17E-07	9.52E-12	3.51E-07	1.42E-06	2.09E-05
7,333	4.48E-08	2.23E-08	4.55E-08	1.85E-07	7.82E-12	2.98E-07	1.17E-06	1.77E-05
8,667	3.50E-08	1.93E-08	3.98E-08	1.63E-07	6.92E-12	2.57E-07	1.01E-06	1.53E-05
10,667	2.58E-08	2.54E-08	3.36E-08	1.87E-07	9.88E-12	2.72E-07	1.33E-06	1.61E-05
12,667	2.01E-08	1.15E-08	2.92E-08	1.06E-07	3.89E-12	1.67E-07	6.00E-07	9.91E-06
14,667	1.62E-08	1.79E-08	2.58E-08	1.30E-07	6.46E-12	1.90E-07	9.38E-07	1.13E-05
17,333	1.27E-08	1.88E-08	2.21E-08	1.19E-07	6.09E-12	1.73E-07	9.83E-07	1.02E-05
21,667	1.02E-08	1.33E-08	2.32E-08	8.98E-08	3.42E-12	1.36E-07	6.92E-07	8.08E-06

Table D.I.58: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1200 MW$_e$ ouput power each (2080) - children aged 2-7

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	1.43E-06	2.32E-07	1.30E-07	7.62E-07	4.33E-11	2.56E-06	1.21E-05	1.52E-04
1,333	4.09E-07	1.21E-07	1.10E-07	5.00E-07	2.58E-11	1.14E-06	6.35E-06	6.75E-05
2,333	2.45E-07	8.15E-08	7.93E-08	3.45E-07	1.62E-11	7.50E-07	4.28E-06	4.44E-05
3,333	1.44E-07	5.88E-08	5.78E-08	2.58E-07	1.24E-11	5.18E-07	3.08E-06	3.07E-05
4,333	9.75E-08	5.76E-08	4.51E-08	2.41E-07	1.31E-11	4.41E-07	3.02E-06	2.60E-05
5,333	7.17E-08	3.01E-08	3.74E-08	1.41E-07	5.81E-12	2.81E-07	1.57E-06	1.66E-05
6,333	5.56E-08	2.71E-08	3.23E-08	1.28E-07	5.53E-12	2.43E-07	1.42E-06	1.44E-05
7,333	4.48E-08	2.23E-08	2.86E-08	1.09E-07	4.54E-12	2.05E-07	1.17E-06	1.21E-05
8,667	3.50E-08	1.93E-08	2.51E-08	9.63E-08	4.02E-12	1.76E-07	1.01E-06	1.04E-05
10,667	2.58E-08	2.54E-08	2.12E-08	1.09E-07	5.74E-12	1.81E-07	1.33E-06	1.07E-05
12,667	2.01E-08	1.15E-08	1.84E-08	6.29E-08	2.26E-12	1.13E-07	6.00E-07	6.69E-06
14,667	1.62E-08	1.79E-08	1.62E-08	7.62E-08	3.75E-12	1.27E-07	9.38E-07	7.46E-06
17,333	1.27E-08	1.88E-08	1.40E-08	6.97E-08	3.54E-12	1.15E-07	9.83E-07	6.77E-06
21,667	1.02E-08	1.33E-08	1.47E-08	5.34E-08	1.99E-12	9.15E-08	6.92E-07	5.39E-06

Table D.I.59: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1200 MW$_e$ ouput power each (2080) - children aged 7-12

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	1.43E-06	2.32E-07	7.98E-08	5.62E-07	2.23E-11	2.30E-06	1.21E-05	1.36E-04
1,333	4.09E-07	1.21E-07	6.72E-08	3.77E-07	1.33E-11	9.75E-07	6.35E-06	5.76E-05
2,333	2.45E-07	8.15E-08	4.87E-08	2.67E-07	8.31E-12	6.42E-07	4.28E-06	3.79E-05
3,333	1.44E-07	5.88E-08	3.55E-08	1.98E-07	6.36E-12	4.37E-07	3.08E-06	2.57E-05
4,333	9.75E-08	5.76E-08	2.77E-08	1.79E-07	6.72E-12	3.62E-07	3.02E-06	2.13E-05
5,333	7.17E-08	3.01E-08	2.30E-08	1.13E-07	2.99E-12	2.38E-07	1.57E-06	1.40E-05
6,333	5.56E-08	2.71E-08	1.99E-08	1.01E-07	2.84E-12	2.04E-07	1.42E-06	1.20E-05
7,333	4.48E-08	2.23E-08	1.76E-08	8.71E-08	2.33E-12	1.72E-07	1.17E-06	1.01E-05
8,667	3.50E-08	1.93E-08	1.54E-08	7.65E-08	2.06E-12	1.46E-07	1.01E-06	8.63E-06
10,667	2.58E-08	2.54E-08	1.31E-08	8.14E-08	2.94E-12	1.46E-07	1.33E-06	8.55E-06
12,667	2.01E-08	1.15E-08	1.14E-08	5.16E-08	1.16E-12	9.45E-08	6.00E-07	5.58E-06
14,667	1.62E-08	1.79E-08	1.00E-08	5.82E-08	1.93E-12	1.02E-07	9.38E-07	6.01E-06
17,333	1.27E-08	1.88E-08	8.62E-09	5.30E-08	1.82E-12	9.32E-08	9.83E-07	5.44E-06
21,667	1.02E-08	1.33E-08	9.08E-09	4.38E-08	1.03E-12	7.63E-08	6.92E-07	4.47E-06

Table D.I.60: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1200 MW$_e$ ouput power each (2080) - children aged 12-17

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	1.43E-06	2.32E-07	1.23E-07	4.17E-07	2.94E-11	2.20E-06	1.21E-05	1.30E-04
1,333	4.09E-07	1.21E-07	1.03E-07	2.78E-07	1.75E-11	9.12E-07	6.35E-06	5.38E-05
2,333	2.45E-07	8.15E-08	7.49E-08	2.00E-07	1.10E-11	6.01E-07	4.28E-06	3.54E-05
3,333	1.44E-07	5.88E-08	5.46E-08	1.47E-07	8.39E-12	4.04E-07	3.08E-06	2.38E-05
4,333	9.75E-08	5.76E-08	4.27E-08	1.31E-07	8.85E-12	3.28E-07	3.02E-06	1.93E-05
5,333	7.17E-08	3.01E-08	3.54E-08	8.47E-08	3.94E-12	2.22E-07	1.57E-06	1.31E-05
6,333	5.56E-08	2.71E-08	3.05E-08	7.54E-08	3.75E-12	1.89E-07	1.42E-06	1.11E-05
7,333	4.48E-08	2.23E-08	2.71E-08	6.51E-08	3.08E-12	1.59E-07	1.17E-06	9.38E-06
8,667	3.50E-08	1.93E-08	2.37E-08	5.71E-08	2.72E-12	1.35E-07	1.01E-06	7.96E-06
10,667	2.58E-08	2.54E-08	2.01E-08	5.97E-08	3.87E-12	1.31E-07	1.33E-06	7.67E-06
12,667	2.01E-08	1.15E-08	1.75E-08	3.88E-08	1.53E-12	8.78E-08	6.00E-07	5.18E-06
14,667	1.62E-08	1.79E-08	1.54E-08	4.31E-08	2.54E-12	9.27E-08	9.38E-07	5.42E-06
17,333	1.27E-08	1.88E-08	1.33E-08	3.95E-08	2.41E-12	8.43E-08	9.83E-07	4.91E-06
21,667	1.02E-08	1.33E-08	1.40E-08	3.34E-08	1.37E-12	7.09E-08	6.92E-07	4.15E-06

2×1700 MW$_e$ power alternative

Table D.I.61: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units, approximately 1700 MW$_e$ ouput power each (2020) - adults

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	4.04E-06	1.39E-09	9.95E-08	1.72E-07	1.83E-12	4.31E-06
1,333	1.16E-06	8.06E-10	8.25E-08	1.33E-07	1.09E-12	1.37E-06
2,333	6.92E-07	5.16E-10	6.09E-08	1.04E-07	6.85E-13	8.57E-07
3,333	4.07E-07	3.87E-10	4.45E-08	7.58E-08	5.25E-13	5.28E-07
4,333	2.76E-07	4.03E-10	3.48E-08	5.98E-08	5.56E-13	3.71E-07
5,333	2.03E-07	1.85E-10	2.89E-08	4.89E-08	2.46E-13	2.81E-07
6,333	1.57E-07	1.74E-10	2.49E-08	4.23E-08	2.34E-13	2.25E-07
7,333	1.27E-07	1.43E-10	2.21E-08	3.75E-08	1.92E-13	1.86E-07
8,667	9.89E-08	1.26E-10	1.94E-08	3.29E-08	1.70E-13	1.51E-07
10,667	7.29E-08	1.76E-10	1.65E-08	2.83E-08	2.43E-13	1.18E-07
12,667	5.66E-08	7.13E-11	1.44E-08	2.42E-08	9.56E-14	9.53E-08
14,667	4.57E-08	1.17E-10	1.27E-08	2.17E-08	1.59E-13	8.02E-08
17,333	3.58E-08	1.13E-10	1.10E-08	1.88E-08	1.50E-13	6.58E-08
21,667	2.84E-08	6.68E-11	1.16E-08	1.97E-08	8.39E-14	5.99E-08

Table D.I.62: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2020) - children aged 0-1

Distance	Dose from the cloud	Dose from the deposit	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	4.04E-06	1.39E-09	4.21E-08	2.04E-07	1.68E-12	4.29E-06
1,333	1.16E-06	8.06E-10	3.53E-08	1.58E-07	1.01E-12	1.35E-06
2,333	6.92E-07	5.16E-10	2.58E-08	1.23E-07	6.29E-13	8.42E-07
3,333	4.07E-07	3.87E-10	1.88E-08	8.99E-08	4.82E-13	5.16E-07
4,333	2.76E-07	4.03E-10	1.47E-08	7.08E-08	5.11E-13	3.62E-07
5,333	2.03E-07	1.85E-10	1.22E-08	5.80E-08	2.25E-13	2.73E-07
6,333	1.57E-07	1.74E-10	1.06E-08	5.02E-08	2.15E-13	2.18E-07
7,333	1.27E-07	1.43E-10	9.37E-09	4.45E-08	1.76E-13	1.81E-07
8,667	9.89E-08	1.26E-10	8.21E-09	3.90E-08	1.56E-13	1.46E-07
10,667	7.29E-08	1.76E-10	6.97E-09	3.35E-08	2.24E-13	1.14E-07
12,667	5.66E-08	7.13E-11	6.07E-09	2.88E-08	8.77E-14	9.15E-08
14,667	4.57E-08	1.17E-10	5.37E-09	2.57E-08	1.46E-13	7.69E-08
17,333	3.58E-08	1.13E-10	4.64E-09	2.23E-08	1.37E-13	6.29E-08
21,667	2.84E-08	6.68E-11	4.92E-09	2.34E-08	7.66E-14	5.68E-08

Table D.I.63: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2020) - children aged 1-2

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	4.04E-06	1.39E-09	1.24E-07	4.52E-07	5.38E-12	4.62E-06
1,333	1.16E-06	8.06E-10	1.04E-07	3.42E-07	3.23E-12	1.60E-06
2,333	6.92E-07	5.16E-10	7.60E-08	2.62E-07	2.02E-12	1.03E-06
3,333	4.07E-07	3.87E-10	5.55E-08	1.92E-07	1.55E-12	6.55E-07
4,333	2.76E-07	4.03E-10	4.34E-08	1.55E-07	1.64E-12	4.75E-07
5,333	2.03E-07	1.85E-10	3.60E-08	1.21E-07	7.23E-13	3.60E-07
6,333	1.57E-07	1.74E-10	3.11E-08	1.06E-07	6.90E-13	2.94E-07
7,333	1.27E-07	1.43E-10	2.76E-08	9.34E-08	5.66E-13	2.48E-07
8,667	9.89E-08	1.26E-10	2.42E-08	8.19E-08	5.02E-13	2.05E-07
10,667	7.29E-08	1.76E-10	2.05E-08	7.30E-08	7.18E-13	1.67E-07
12,667	5.66E-08	7.13E-11	1.79E-08	5.96E-08	2.81E-13	1.34E-07
14,667	4.57E-08	1.17E-10	1.58E-08	5.52E-08	4.68E-13	1.17E-07
17,333	3.58E-08	1.13E-10	1.37E-08	4.82E-08	4.40E-13	9.78E-08
21,667	2.84E-08	6.68E-11	1.45E-08	4.86E-08	2.45E-13	9.16E-08

Table D.I.64: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2020) - children aged 2-7

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	4.04E-06	1.39E-09	7.90E-08	2.76E-07	3.11E-12	4.40E-06
1,333	1.16E-06	8.06E-10	6.59E-08	2.10E-07	1.87E-12	1.43E-06
2,333	6.92E-07	5.16E-10	4.83E-08	1.61E-07	1.17E-12	9.02E-07
3,333	4.07E-07	3.87E-10	3.53E-08	1.18E-07	8.95E-13	5.61E-07

4,333	2.76E-07	4.03E-10	2.76E-08	9.51E-08	9.48E-13	3.99E-07
5,333	2.03E-07	1.85E-10	2.29E-08	7.48E-08	4.18E-13	3.00E-07
6,333	1.57E-07	1.74E-10	1.98E-08	6.50E-08	3.99E-13	2.42E-07
7,333	1.27E-07	1.43E-10	1.76E-08	5.75E-08	3.27E-13	2.02E-07
8,667	9.89E-08	1.26E-10	1.54E-08	5.04E-08	2.90E-13	1.65E-07
10,667	7.29E-08	1.76E-10	1.31E-08	4.47E-08	4.15E-13	1.31E-07
12,667	5.66E-08	7.13E-11	1.14E-08	3.67E-08	1.63E-13	1.05E-07
14,667	4.57E-08	1.17E-10	1.01E-08	3.39E-08	2.71E-13	8.98E-08
17,333	3.58E-08	1.13E-10	8.70E-09	2.96E-08	2.55E-13	7.42E-08
21,667	2.84E-08	6.68E-11	9.22E-09	2.99E-08	1.42E-13	6.77E-08

Table D.I.65: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2020) - children aged 7-12

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	4.04E-06	1.39E-09	4.98E-08	2.54E-07	1.58E-12	4.34E-06
1,333	1.16E-06	8.06E-10	4.15E-08	1.95E-07	9.47E-13	1.39E-06
2,333	6.92E-07	5.16E-10	3.05E-08	1.51E-07	5.92E-13	8.74E-07
3,333	4.07E-07	3.87E-10	2.23E-08	1.10E-07	4.54E-13	5.40E-07
4,333	2.76E-07	4.03E-10	1.74E-08	8.78E-08	4.81E-13	3.81E-07
5,333	2.03E-07	1.85E-10	1.44E-08	7.05E-08	2.12E-13	2.88E-07
6,333	1.57E-07	1.74E-10	1.25E-08	6.12E-08	2.03E-13	2.31E-07
7,333	1.27E-07	1.43E-10	1.11E-08	5.42E-08	1.66E-13	1.92E-07
8,667	9.89E-08	1.26E-10	9.72E-09	4.75E-08	1.47E-13	1.56E-07
10,667	7.29E-08	1.76E-10	8.25E-09	4.14E-08	2.11E-13	1.23E-07
12,667	5.66E-08	7.13E-11	7.18E-09	3.48E-08	8.27E-14	9.87E-08
14,667	4.57E-08	1.17E-10	6.35E-09	3.16E-08	1.37E-13	8.38E-08
17,333	3.58E-08	1.13E-10	5.49E-09	2.75E-08	1.29E-13	6.89E-08
21,667	2.84E-08	6.68E-11	5.82E-09	2.83E-08	7.23E-14	6.27E-08

Table D.I.66: Annual effective doses from external irradiation and committed effective doses from annual intake during the 1st year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2020) - children aged 12-17

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	4.04E-06	1.39E-09	7.90E-08	1.92E-07	2.06E-12	4.31E-06
1,333	1.16E-06	8.06E-10	6.54E-08	1.48E-07	1.23E-12	1.37E-06
2,333	6.92E-07	5.16E-10	4.83E-08	1.15E-07	7.71E-13	8.56E-07
3,333	4.07E-07	3.87E-10	3.53E-08	8.39E-08	5.91E-13	5.27E-07
4,333	2.76E-07	4.03E-10	2.76E-08	6.66E-08	6.26E-13	3.70E-07
5,333	2.03E-07	1.85E-10	2.29E-08	5.38E-08	2.77E-13	2.79E-07
6,333	1.57E-07	1.74E-10	1.98E-08	4.66E-08	2.64E-13	2.24E-07
7,333	1.27E-07	1.43E-10	1.76E-08	4.13E-08	2.17E-13	1.86E-07
8,667	9.89E-08	1.26E-10	1.54E-08	3.62E-08	1.92E-13	1.51E-07
10,667	7.29E-08	1.76E-10	1.31E-08	3.14E-08	2.74E-13	1.18E-07
12,667	5.66E-08	7.13E-11	1.14E-08	2.66E-08	1.08E-13	9.47E-08
14,667	4.57E-08	1.17E-10	1.01E-08	2.40E-08	1.79E-13	7.99E-08
17,333	3.58E-08	1.13E-10	8.71E-09	2.09E-08	1.69E-13	6.55E-08
21,667	2.84E-08	6.68E-11	9.23E-09	2.17E-08	9.44E-14	5.94E-08

Table D.I.67: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2050) - adults

Distance	Dose from the cloud	Committed dose from inhalation in 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	4.04E-06	4.35E-09	9.95E-08	1.72E-07	1.83E-12	4.32E-06	1.07E-07	1.29E-04
1,333	1.16E-06	2.34E-09	8.25E-08	1.33E-07	1.09E-12	1.38E-06	5.83E-08	4.13E-05
2,333	6.92E-07	1.56E-09	6.09E-08	1.04E-07	6.85E-13	8.58E-07	3.89E-08	2.57E-05
3,333	4.07E-07	1.13E-09	4.45E-08	7.58E-08	5.25E-13	5.29E-07	2.82E-08	1.59E-05
4,333	2.76E-07	1.13E-09	3.48E-08	5.98E-08	5.56E-13	3.71E-07	2.82E-08	1.11E-05
5,333	2.03E-07	5.68E-10	2.89E-08	4.89E-08	2.46E-13	2.81E-07	1.40E-08	8.42E-06
6,333	1.57E-07	5.18E-10	2.49E-08	4.23E-08	2.34E-13	2.25E-07	1.28E-08	6.74E-06
7,333	1.27E-07	4.25E-10	2.21E-08	3.75E-08	1.92E-13	1.87E-07	1.06E-08	5.60E-06
8,667	9.89E-08	3.70E-10	1.94E-08	3.29E-08	1.70E-13	1.52E-07	9.19E-09	4.55E-06
10,667	7.29E-08	4.97E-10	1.65E-08	2.83E-08	2.43E-13	1.18E-07	1.24E-08	3.54E-06
12,667	5.66E-08	2.17E-10	1.44E-08	2.42E-08	9.56E-14	9.54E-08	5.38E-09	2.86E-06
14,667	4.57E-08	3.44E-10	1.27E-08	2.17E-08	1.59E-13	8.04E-08	8.55E-09	2.41E-06
17,333	3.58E-08	3.53E-10	1.10E-08	1.88E-08	1.50E-13	6.60E-08	8.71E-09	1.98E-06
21,667	2.84E-08	2.38E-10	1.16E-08	1.97E-08	8.39E-14	6.00E-08	5.81E-09	1.80E-06

Table D.I.68: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units. approximately 1700 MW_e ouput power each (2050) - children aged 0-1

Distance	Dose from the cloud	Committed dose from inhalation in 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	4.04E-06	4.35E-09	4.21E-08	2.05E-07	1.68E-12	4.29E-06	1.07E-07	1.29E-04
1,333	1.16E-06	2.34E-09	3.53E-08	1.59E-07	1.01E-12	1.35E-06	5.83E-08	4.06E-05
2,333	6.92E-07	1.56E-09	2.58E-08	1.24E-07	6.29E-13	8.43E-07	3.89E-08	2.53E-05
3,333	4.07E-07	1.13E-09	1.88E-08	9.03E-08	4.82E-13	5.17E-07	2.82E-08	1.55E-05
4,333	2.76E-07	1.13E-09	1.47E-08	7.12E-08	5.11E-13	3.63E-07	2.82E-08	1.09E-05
5,333	2.03E-07	5.68E-10	1.22E-08	5.82E-08	2.25E-13	2.74E-07	1.40E-08	8.20E-06
6,333	1.57E-07	5.18E-10	1.06E-08	5.04E-08	2.15E-13	2.19E-07	1.28E-08	6.55E-06
7,333	1.27E-07	4.25E-10	9.37E-09	4.47E-08	1.76E-13	1.81E-07	1.06E-08	5.43E-06
8,667	9.89E-08	3.70E-10	8.21E-09	3.92E-08	1.56E-13	1.47E-07	9.19E-09	4.40E-06
10,667	7.29E-08	4.97E-10	6.97E-09	3.37E-08	2.24E-13	1.14E-07	1.24E-08	3.42E-06
12,667	5.66E-08	2.17E-10	6.07E-09	2.88E-08	8.77E-14	9.18E-08	5.38E-09	2.75E-06
14,667	4.57E-08	3.44E-10	5.37E-09	2.58E-08	1.46E-13	7.72E-08	8.55E-09	2.32E-06
17,333	3.58E-08	3.53E-10	4.64E-09	2.24E-08	1.37E-13	6.32E-08	8.71E-09	1.90E-06
21,667	2.84E-08	2.38E-10	4.92E-09	2.35E-08	7.66E-14	5.71E-08	5.81E-09	1.71E-06

Table D.I.69: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1700 MW$_e$ ouput power each (2050) - children aged 1-2

Distance	Dose from the cloud	Committed dose from inhalation in 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	4.04E-06	4.35E-09	1.24E-07	4.53E-07	5.38E-12	4.62E-06	1.07E-07	1.39E-04
1,333	1.16E-06	2.34E-09	1.04E-07	3.43E-07	3.23E-12	1.61E-06	5.83E-08	4.82E-05
2,333	6.92E-07	1.56E-09	7.60E-08	2.62E-07	2.02E-12	1.03E-06	3.89E-08	3.10E-05
3,333	4.07E-07	1.13E-09	5.55E-08	1.93E-07	1.55E-12	6.56E-07	2.82E-08	1.97E-05
4,333	2.76E-07	1.13E-09	4.34E-08	1.56E-07	1.64E-12	4.76E-07	2.82E-08	1.43E-05
5,333	2.03E-07	5.68E-10	3.60E-08	1.22E-07	7.23E-13	3.61E-07	1.40E-08	1.08E-05
6,333	1.57E-07	5.18E-10	3.11E-08	1.06E-07	6.90E-13	2.95E-07	1.28E-08	8.84E-06
7,333	1.27E-07	4.25E-10	2.76E-08	9.35E-08	5.66E-13	2.48E-07	1.06E-08	7.44E-06
8,667	9.89E-08	3.70E-10	2.42E-08	8.20E-08	5.02E-13	2.05E-07	9.19E-09	6.16E-06
10,667	7.29E-08	4.97E-10	2.05E-08	7.31E-08	7.18E-13	1.67E-07	1.24E-08	5.01E-06
12,667	5.66E-08	2.17E-10	1.79E-08	5.96E-08	2.81E-13	1.34E-07	5.38E-09	4.03E-06
14,667	4.57E-08	3.44E-10	1.58E-08	5.53E-08	4.68E-13	1.17E-07	8.55E-09	3.51E-06
17,333	3.58E-08	3.53E-10	1.37E-08	4.83E-08	4.40E-13	9.81E-08	8.71E-09	2.94E-06
21,667	2.84E-08	2.38E-10	1.45E-08	4.86E-08	2.45E-13	9.18E-08	5.81E-09	2.75E-06

Table D.I.70: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1700 MW$_e$ ouput power each (2050) - children aged 2-7

Distance	Dose from the cloud	Committed dose from inhalation in 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	4.04E-06	4.35E-09	7.90E-08	2.77E-07	3.11E-12	4.40E-06	1.07E-07	1.32E-04
1,333	1.16E-06	2.34E-09	6.59E-08	2.10E-07	1.87E-12	1.44E-06	5.83E-08	4.31E-05
2,333	6.92E-07	1.56E-09	4.83E-08	1.61E-07	1.17E-12	9.03E-07	3.89E-08	2.71E-05
3,333	4.07E-07	1.13E-09	3.53E-08	1.18E-07	8.95E-13	5.62E-07	2.82E-08	1.68E-05
4,333	2.76E-07	1.13E-09	2.76E-08	9.53E-08	9.48E-13	4.00E-07	2.82E-08	1.20E-05
5,333	2.03E-07	5.68E-10	2.29E-08	7.49E-08	4.18E-13	3.01E-07	1.40E-08	9.02E-06
6,333	1.57E-07	5.18E-10	1.98E-08	6.51E-08	3.99E-13	2.43E-07	1.28E-08	7.27E-06
7,333	1.27E-07	4.25E-10	1.76E-08	5.75E-08	3.27E-13	2.02E-07	1.06E-08	6.06E-06
8,667	9.89E-08	3.70E-10	1.54E-08	5.05E-08	2.90E-13	1.65E-07	9.19E-09	4.95E-06
10,667	7.29E-08	4.97E-10	1.31E-08	4.48E-08	4.15E-13	1.31E-07	1.24E-08	3.93E-06
12,667	5.66E-08	2.17E-10	1.14E-08	3.67E-08	1.63E-13	1.05E-07	5.38E-09	3.15E-06
14,667	4.57E-08	3.44E-10	1.01E-08	3.40E-08	2.71E-13	9.01E-08	8.55E-09	2.70E-06
17,333	3.58E-08	3.53E-10	8.70E-09	2.96E-08	2.55E-13	7.45E-08	8.71E-09	2.23E-06
21,667	2.84E-08	2.38E-10	9.22E-09	3.00E-08	1.42E-13	6.79E-08	5.81E-09	2.03E-06

Table D.I.71: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2050) - children aged 7-12

Distance	Dose from the cloud	Committed dose from inhalation in 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	4.04E-06	4.35E-09	4.98E-08	2.55E-07	1.58E-12	4.35E-06	1.07E-07	1.30E-04
1,333	1.16E-06	2.34E-09	4.15E-08	1.95E-07	9.47E-13	1.40E-06	5.83E-08	4.19E-05
2,333	6.92E-07	1.56E-09	3.05E-08	1.51E-07	5.92E-13	8.75E-07	3.89E-08	2.62E-05
3,333	4.07E-07	1.13E-09	2.23E-08	1.10E-07	4.54E-13	5.41E-07	2.82E-08	1.62E-05
4,333	2.76E-07	1.13E-09	1.74E-08	8.80E-08	4.81E-13	3.82E-07	2.82E-08	1.15E-05
5,333	2.03E-07	5.68E-10	1.44E-08	7.06E-08	2.12E-13	2.88E-07	1.40E-08	8.64E-06
6,333	1.57E-07	5.18E-10	1.25E-08	6.13E-08	2.03E-13	2.31E-07	1.28E-08	6.94E-06
7,333	1.27E-07	4.25E-10	1.11E-08	5.43E-08	1.66E-13	1.92E-07	1.06E-08	5.77E-06
8,667	9.89E-08	3.70E-10	9.72E-09	4.76E-08	1.47E-13	1.57E-07	9.19E-09	4.70E-06
10,667	7.29E-08	4.97E-10	8.25E-09	4.15E-08	2.11E-13	1.23E-07	1.24E-08	3.69E-06
12,667	5.66E-08	2.17E-10	7.18E-09	3.49E-08	8.27E-14	9.89E-08	5.38E-09	2.97E-06
14,667	4.57E-08	3.44E-10	6.35E-09	3.17E-08	1.37E-13	8.41E-08	8.55E-09	2.52E-06
17,333	3.58E-08	3.53E-10	5.49E-09	2.76E-08	1.29E-13	6.92E-08	8.71E-09	2.07E-06
21,667	2.84E-08	2.38E-10	5.82E-09	2.84E-08	7.23E-14	6.29E-08	5.81E-09	1.89E-06

Table D.I.72: Annual effective doses from external irradiation and committed effective doses from annual intake during the 30th year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2050) - children aged 12-17

Distance	Dose from the cloud	Committed dose from inhalation in 30th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in 30th year of operation	Integral dose from the deposit	Effective dose over 30 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/30 yrs]	[Sv/30 yrs]
667	4.04E-06	4.35E-09	7.90E-08	1.94E-07	2.06E-12	4.32E-06	1.07E-07	1.29E-04
1,333	1.16E-06	2.34E-09	6.54E-08	1.49E-07	1.23E-12	1.37E-06	5.83E-08	4.12E-05
2,333	6.92E-07	1.56E-09	4.83E-08	1.15E-07	7.71E-13	8.57E-07	3.89E-08	2.57E-05
3,333	4.07E-07	1.13E-09	3.53E-08	8.43E-08	5.91E-13	5.28E-07	2.82E-08	1.58E-05
4,333	2.76E-07	1.13E-09	2.76E-08	6.69E-08	6.26E-13	3.71E-07	2.82E-08	1.11E-05
5,333	2.03E-07	5.68E-10	2.29E-08	5.40E-08	2.77E-13	2.80E-07	1.40E-08	8.40E-06
6,333	1.57E-07	5.18E-10	1.98E-08	4.68E-08	2.64E-13	2.24E-07	1.28E-08	6.72E-06
7,333	1.27E-07	4.25E-10	1.76E-08	4.15E-08	2.17E-13	1.86E-07	1.06E-08	5.58E-06
8,667	9.89E-08	3.70E-10	1.54E-08	3.64E-08	1.92E-13	1.51E-07	9.19E-09	4.53E-06
10,667	7.29E-08	4.97E-10	1.31E-08	3.16E-08	2.74E-13	1.18E-07	1.24E-08	3.54E-06
12,667	5.66E-08	2.17E-10	1.14E-08	2.67E-08	1.08E-13	9.49E-08	5.38E-09	2.85E-06
14,667	4.57E-08	3.44E-10	1.01E-08	2.41E-08	1.79E-13	8.03E-08	8.55E-09	2.41E-06
17,333	3.58E-08	3.53E-10	8.71E-09	2.10E-08	1.69E-13	6.59E-08	8.71E-09	1.97E-06
21,667	2.84E-08	2.38E-10	9.23E-09	2.17E-08	9.44E-14	5.97E-08	5.81E-09	1.79E-06

Table D.I.73: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2080) - adults

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	4.04E-06	4.54E-09	9.95E-08	1.72E-07	1.83E-12	4.32E-06	2.42E-07	2.59E-04
1,333	1.16E-06	2.44E-09	8.25E-08	1.33E-07	1.09E-12	1.38E-06	1.30E-07	8.26E-05
2,333	6.92E-07	1.62E-09	6.09E-08	1.04E-07	6.85E-13	8.59E-07	8.70E-08	5.15E-05
3,333	4.07E-07	1.18E-09	4.45E-08	7.58E-08	5.25E-13	5.29E-07	6.31E-08	3.17E-05
4,333	2.76E-07	1.17E-09	3.48E-08	5.98E-08	5.56E-13	3.71E-07	6.30E-08	2.23E-05
5,333	2.03E-07	5.92E-10	2.89E-08	4.89E-08	2.46E-13	2.81E-07	3.16E-08	1.69E-05
6,333	1.57E-07	5.39E-10	2.49E-08	4.23E-08	2.34E-13	2.25E-07	2.88E-08	1.35E-05
7,333	1.27E-07	4.43E-10	2.21E-08	3.75E-08	1.92E-13	1.87E-07	2.37E-08	1.12E-05
8,667	9.89E-08	3.85E-10	1.94E-08	3.29E-08	1.70E-13	1.52E-07	2.06E-08	9.09E-06
10,667	7.29E-08	5.17E-10	1.65E-08	2.83E-08	2.43E-13	1.18E-07	2.77E-08	7.09E-06
12,667	5.66E-08	2.26E-10	1.44E-08	2.42E-08	9.56E-14	9.54E-08	1.21E-08	5.72E-06
14,667	4.57E-08	3.58E-10	1.27E-08	2.17E-08	1.59E-13	8.05E-08	1.92E-08	4.83E-06
17,333	3.58E-08	3.68E-10	1.10E-08	1.88E-08	1.50E-13	6.60E-08	1.96E-08	3.96E-06
21,667	2.84E-08	2.49E-10	1.16E-08	1.97E-08	8.39E-14	6.01E-08	1.32E-08	3.60E-06

Table D.I.74: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2080) - children aged 0-1

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	4.04E-06	4.54E-09	4.21E-08	2.05E-07	1.68E-12	4.29E-06	2.42E-07	2.57E-04
1,333	1.16E-06	2.44E-09	3.53E-08	1.59E-07	1.01E-12	1.35E-06	1.30E-07	8.13E-05
2,333	6.92E-07	1.62E-09	2.58E-08	1.24E-07	6.29E-13	8.43E-07	8.70E-08	5.06E-05
3,333	4.07E-07	1.18E-09	1.88E-08	9.03E-08	4.82E-13	5.17E-07	6.31E-08	3.10E-05
4,333	2.76E-07	1.17E-09	1.47E-08	7.12E-08	5.11E-13	3.63E-07	6.30E-08	2.18E-05
5,333	2.03E-07	5.92E-10	1.22E-08	5.82E-08	2.25E-13	2.74E-07	3.16E-08	1.64E-05
6,333	1.57E-07	5.39E-10	1.06E-08	5.04E-08	2.15E-13	2.19E-07	2.88E-08	1.31E-05
7,333	1.27E-07	4.43E-10	9.37E-09	4.47E-08	1.76E-13	1.81E-07	2.37E-08	1.09E-05
8,667	9.89E-08	3.85E-10	8.21E-09	3.92E-08	1.56E-13	1.47E-07	2.06E-08	8.80E-06
10,667	7.29E-08	5.17E-10	6.97E-09	3.37E-08	2.24E-13	1.14E-07	2.77E-08	6.84E-06
12,667	5.66E-08	2.26E-10	6.07E-09	2.89E-08	8.77E-14	9.18E-08	1.21E-08	5.50E-06
14,667	4.57E-08	3.58E-10	5.37E-09	2.59E-08	1.46E-13	7.73E-08	1.92E-08	4.63E-06
17,333	3.58E-08	3.68E-10	4.64E-09	2.24E-08	1.37E-13	6.33E-08	1.96E-08	3.79E-06
21,667	2.84E-08	2.49E-10	4.92E-09	2.35E-08	7.66E-14	5.71E-08	1.32E-08	3.42E-06

Table D.I.75: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2080) - children aged 1-2

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	4.04E-06	4.54E-09	1.24E-07	4.53E-07	5.38E-12	4.62E-06	2.42E-07	2.77E-04
1,333	1.16E-06	2.44E-09	1.04E-07	3.43E-07	3.23E-12	1.61E-06	1.30E-07	9.64E-05
2,333	6.92E-07	1.62E-09	7.60E-08	2.62E-07	2.02E-12	1.03E-06	8.70E-08	6.19E-05
3,333	4.07E-07	1.18E-09	5.55E-08	1.93E-07	1.55E-12	6.56E-07	6.31E-08	3.94E-05
4,333	2.76E-07	1.17E-09	4.34E-08	1.56E-07	1.64E-12	4.76E-07	6.30E-08	2.85E-05
5,333	2.03E-07	5.92E-10	3.60E-08	1.22E-07	7.23E-13	3.61E-07	3.16E-08	2.16E-05
6,333	1.57E-07	5.39E-10	3.11E-08	1.06E-07	6.90E-13	2.95E-07	2.88E-08	1.77E-05
7,333	1.27E-07	4.43E-10	2.76E-08	9.35E-08	5.66E-13	2.48E-07	2.37E-08	1.49E-05
8,667	9.89E-08	3.85E-10	2.42E-08	8.20E-08	5.02E-13	2.06E-07	2.06E-08	1.23E-05
10,667	7.29E-08	5.17E-10	2.05E-08	7.31E-08	7.18E-13	1.67E-07	2.77E-08	1.00E-05
12,667	5.66E-08	2.26E-10	1.79E-08	5.96E-08	2.81E-13	1.34E-07	1.21E-08	8.06E-06
14,667	4.57E-08	3.58E-10	1.58E-08	5.53E-08	4.68E-13	1.17E-07	1.92E-08	7.03E-06
17,333	3.58E-08	3.68E-10	1.37E-08	4.83E-08	4.40E-13	9.82E-08	1.96E-08	5.89E-06
21,667	2.84E-08	2.49E-10	1.45E-08	4.86E-08	2.45E-13	9.18E-08	1.32E-08	5.51E-06

Table D.I.76: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2080) - children aged 2-7

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	4.04E-06	4.54E-09	7.90E-08	2.77E-07	3.11E-12	4.40E-06	2.42E-07	2.64E-04
1,333	1.16E-06	2.44E-09	6.59E-08	2.10E-07	1.87E-12	1.44E-06	1.30E-07	8.62E-05
2,333	6.92E-07	1.62E-09	4.83E-08	1.61E-07	1.17E-12	9.03E-07	8.70E-08	5.42E-05
3,333	4.07E-07	1.18E-09	3.53E-08	1.18E-07	8.95E-13	5.62E-07	6.31E-08	3.37E-05
4,333	2.76E-07	1.17E-09	2.76E-08	9.53E-08	9.48E-13	4.00E-07	6.30E-08	2.40E-05
5,333	2.03E-07	5.92E-10	2.29E-08	7.49E-08	4.18E-13	3.01E-07	3.16E-08	1.81E-05
6,333	1.57E-07	5.39E-10	1.98E-08	6.51E-08	3.99E-13	2.43E-07	2.88E-08	1.46E-05
7,333	1.27E-07	4.43E-10	1.76E-08	5.75E-08	3.27E-13	2.02E-07	2.37E-08	1.21E-05
8,667	9.89E-08	3.85E-10	1.54E-08	5.05E-08	2.90E-13	1.65E-07	2.06E-08	9.91E-06
10,667	7.29E-08	5.17E-10	1.31E-08	4.48E-08	4.15E-13	1.31E-07	2.77E-08	7.87E-06
12,667	5.66E-08	2.26E-10	1.14E-08	3.67E-08	1.63E-13	1.05E-07	1.21E-08	6.30E-06
14,667	4.57E-08	3.58E-10	1.01E-08	3.40E-08	2.71E-13	9.01E-08	1.92E-08	5.40E-06
17,333	3.58E-08	3.68E-10	8.70E-09	2.96E-08	2.55E-13	7.45E-08	1.96E-08	4.47E-06
21,667	2.84E-08	2.49E-10	9.22E-09	3.00E-08	1.42E-13	6.79E-08	1.32E-08	4.07E-06

Table D.I.77: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2080) - children aged 7-12

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	4.04E-06	4.54E-09	4.98E-08	2.55E-07	1.58E-12	4.35E-06	2.42E-07	2.61E-04
1,333	1.16E-06	2.44E-09	4.15E-08	1.95E-07	9.47E-13	1.40E-06	1.30E-07	8.38E-05
2,333	6.92E-07	1.62E-09	3.05E-08	1.51E-07	5.92E-13	8.75E-07	8.70E-08	5.25E-05
3,333	4.07E-07	1.18E-09	2.23E-08	1.11E-07	4.54E-13	5.41E-07	6.31E-08	3.25E-05
4,333	2.76E-07	1.17E-09	1.74E-08	8.81E-08	4.81E-13	3.82E-07	6.30E-08	2.29E-05
5,333	2.03E-07	5.92E-10	1.44E-08	7.06E-08	2.12E-13	2.88E-07	3.16E-08	1.73E-05
6,333	1.57E-07	5.39E-10	1.25E-08	6.13E-08	2.03E-13	2.31E-07	2.88E-08	1.39E-05
7,333	1.27E-07	4.43E-10	1.11E-08	5.43E-08	1.66E-13	1.92E-07	2.37E-08	1.15E-05
8,667	9.89E-08	3.85E-10	9.72E-09	4.76E-08	1.47E-13	1.57E-07	2.06E-08	9.39E-06
10,667	7.29E-08	5.17E-10	8.25E-09	4.15E-08	2.11E-13	1.23E-07	2.77E-08	7.39E-06
12,667	5.66E-08	2.26E-10	7.18E-09	3.49E-08	8.27E-14	9.89E-08	1.21E-08	5.93E-06
14,667	4.57E-08	3.58E-10	6.35E-09	3.17E-08	1.37E-13	8.41E-08	1.92E-08	5.04E-06
17,333	3.58E-08	3.68E-10	5.49E-09	2.76E-08	1.29E-13	6.92E-08	1.96E-08	4.15E-06
21,667	2.84E-08	2.49E-10	5.82E-09	2.84E-08	7.23E-14	6.29E-08	1.32E-08	3.77E-06

Table D.I.78: Annual effective doses from external irradiation and committed effective doses from annual intake during the 60th year of operation of the 2 new reactor units, approximately 1700 MW_e ouput power each (2080) - children aged 12-17

Distance	Dose from the cloud	Dose from the deposit in the 60th year of operation	Committed dose from inhalation	Committed dose from ingestion	Committed dose from inhalation from resuspension	Annual eff. dose in the 60th year of operation	Integral dose from the deposit	Effective dose over 60 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/60 yrs]	[Sv/60 yrs]
667	4.04E-06	4.54E-09	7.90E-08	1.94E-07	2.06E-12	4.32E-06	2.42E-07	2.59E-04
1,333	1.16E-06	2.44E-09	6.54E-08	1.49E-07	1.23E-12	1.37E-06	1.30E-07	8.25E-05
2,333	6.92E-07	1.62E-09	4.83E-08	1.15E-07	7.71E-13	8.57E-07	8.70E-08	5.14E-05
3,333	4.07E-07	1.18E-09	3.53E-08	8.43E-08	5.91E-13	5.28E-07	6.31E-08	3.17E-05
4,333	2.76E-07	1.17E-09	2.76E-08	6.69E-08	6.26E-13	3.71E-07	6.30E-08	2.23E-05
5,333	2.03E-07	5.92E-10	2.29E-08	5.40E-08	2.77E-13	2.80E-07	3.16E-08	1.68E-05
6,333	1.57E-07	5.39E-10	1.98E-08	4.68E-08	2.64E-13	2.24E-07	2.88E-08	1.35E-05
7,333	1.27E-07	4.43E-10	1.76E-08	4.15E-08	2.17E-13	1.86E-07	2.37E-08	1.12E-05
8,667	9.89E-08	3.85E-10	1.54E-08	3.64E-08	1.92E-13	1.51E-07	2.06E-08	9.06E-06
10,667	7.29E-08	5.17E-10	1.31E-08	3.16E-08	2.74E-13	1.18E-07	2.77E-08	7.08E-06
12,667	5.66E-08	2.26E-10	1.14E-08	2.67E-08	1.08E-13	9.49E-08	1.21E-08	5.69E-06
14,667	4.57E-08	3.58E-10	1.01E-08	2.41E-08	1.79E-13	8.03E-08	1.92E-08	4.81E-06
17,333	3.58E-08	3.68E-10	8.71E-09	2.10E-08	1.69E-13	6.59E-08	1.96E-08	3.95E-06
21,667	2.84E-08	2.49E-10	9.23E-09	2.18E-08	9.44E-14	5.97E-08	1.32E-08	3.58E-06

PLANT (UNITS 1+2+3+4)

Doses from the existing NPP Temelín, given in the tables below, must be added to the above doses from the new nuclear installation in order to obtain total doses from atmospheric discharges from the site.

The tables present annual effective doses / committed doses from annual intake in the given year of operation of the 2 existing NPP Temelín units. The tables for 2020 and 2050 also include integral doses from deposition, i.e. doses in 20 years and in 50 years of NPP Temelín operation, respectively. In 2080, the dose from deposition will be the only dose contributed to the total dose by the current Temelín units. After 2050 (if the existing NPP is shut down), deposition will decrease slowly as the various radionuclides decay. In 2080, only radionuclides with a long half-life, such as ^{63}Ni, ^{90}S, ^{137}Cs, ^{238}Pu, ^{239}Pu and ^{241}Am, can contribute.

Here, too, the highest annual dose was obtained for direction 3, i.e. the northeastern direction, to which the results presented below are related.

Existing plant 2×1000 MW_e

The existing plant has been in operation for more than 5 years on the date of preparation of this document. Thanks to that, the results of plant operation monitoring are available in addition to the design data for the discharges. Therefore, data for doses calculated from both the design data and measured discharge levels is included.

Information on doses calculated from the design discharge levels is included in the following tables:

Table D.I.79: Annual effective doses from external exposure and effective commitments from annual intake in the 1st year of operation, calculated from design values of discharges from the 2 Temelín units, approximately 1000 MWe each - adults

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	7.44E-06	1.11E-09	1.56E-07	2.14E-07	1.92E-12	7.81E-06
1,333	2.09E-06	6.61E-10	1.31E-07	1.66E-07	1.15E-12	2.39E-06
2,333	1.27E-06	4.14E-10	9.56E-08	1.29E-07	7.21E-13	1.49E-06
3,333	7.40E-07	3.17E-10	6.98E-08	9.44E-08	5.54E-13	9.05E-07
4,333	4.99E-07	3.34E-10	5.46E-08	7.44E-08	5.87E-13	6.28E-07
5,333	3.64E-07	1.49E-10	4.53E-08	6.09E-08	2.59E-13	4.71E-07
6,333	2.81E-07	1.41E-10	3.92E-08	5.27E-08	2.47E-13	3.73E-07
7,333	2.25E-07	1.16E-10	3.48E-08	4.68E-08	2.03E-13	3.07E-07
8,667	1.75E-07	1.02E-10	3.05E-08	4.10E-08	1.80E-13	2.46E-07
10,667	1.27E-07	1.45E-10	2.59E-08	3.52E-08	2.57E-13	1.88E-07
12,667	9.78E-08	5.74E-11	2.25E-08	3.02E-08	1.01E-13	1.51E-07
14,667	7.81E-08	9.49E-11	1.99E-08	2.70E-08	1.68E-13	1.25E-07
17,333	6.03E-08	8.97E-11	1.73E-08	2.34E-08	1.58E-13	1.01E-07
21,667	4.66E-08	5.08E-11	1.83E-08	2.46E-08	8.79E-14	8.95E-08

Table D.I.80: Annual effective doses from external exposure and committed effective doses from yearly intake in the 1st year of operation, calculated from the design levels of discharges from the 2 Temelín units, approximately 1000 MWe each - children aged 0-1

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	7.44E-06	1.11E-09	6.83E-08	2.56E-07	1.75E-12	7.76E-06
1,333	2.09E-06	6.61E-10	5.78E-08	2.00E-07	1.05E-12	2.35E-06
2,333	1.27E-06	4.14E-10	4.18E-08	1.55E-07	6.57E-13	1.46E-06
3,333	7.40E-07	3.17E-10	3.05E-08	1.13E-07	5.05E-13	8.84E-07
4,333	4.99E-07	3.34E-10	2.39E-08	8.91E-08	5.35E-13	6.12E-07
5,333	3.64E-07	1.49E-10	1.98E-08	7.31E-08	2.36E-13	4.58E-07
6,333	2.81E-07	1.41E-10	1.71E-08	6.32E-08	2.25E-13	3.62E-07
7,333	2.25E-07	1.16E-10	1.52E-08	5.61E-08	1.85E-13	2.97E-07
8,667	1.75E-07	1.02E-10	1.33E-08	4.92E-08	1.64E-13	2.37E-07
10,667	1.27E-07	1.45E-10	1.13E-08	4.21E-08	2.34E-13	1.81E-07
12,667	9.78E-08	5.74E-11	9.85E-09	3.63E-08	9.18E-14	1.44E-07
14,667	7.81E-08	9.49E-11	8.72E-09	3.24E-08	1.53E-13	1.19E-07
17,333	6.03E-08	8.97E-11	7.54E-09	2.81E-08	1.44E-13	9.60E-08
21,667	4.66E-08	5.08E-11	7.99E-09	2.95E-08	8.00E-14	8.41E-08

Table D.I.81: Annual effective doses from external exposure and committed effective doses from yearly intake in the 1st year of operation, calculated from the design levels of discharges from the 2 Temelín units, approximately 1000 MWe each - children aged 1-2

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	7.44E-06	1.11E-09	2.00E-07	5.58E-07	5.65E-12	8.20E-06
1,333	2.09E-06	6.61E-10	1.69E-07	4.24E-07	3.39E-12	2.69E-06
2,333	1.27E-06	4.14E-10	1.22E-07	3.25E-07	2.12E-12	1.71E-06
3,333	7.40E-07	3.17E-10	8.93E-08	2.38E-07	1.63E-12	1.07E-06
4,333	4.99E-07	3.34E-10	6.98E-08	1.92E-07	1.73E-12	7.61E-07
5,333	3.64E-07	1.49E-10	5.79E-08	1.51E-07	7.60E-13	5.73E-07
6,333	2.81E-07	1.41E-10	5.01E-08	1.31E-07	7.26E-13	4.63E-07
7,333	2.25E-07	1.16E-10	4.45E-08	1.16E-07	5.96E-13	3.86E-07
8,667	1.75E-07	1.02E-10	3.90E-08	1.02E-07	5.28E-13	3.15E-07
10,667	1.27E-07	1.45E-10	3.31E-08	9.02E-08	7.56E-13	2.51E-07
12,667	9.78E-08	5.74E-11	2.88E-08	7.41E-08	2.96E-13	2.01E-07
14,667	7.81E-08	9.49E-11	2.55E-08	6.84E-08	4.93E-13	1.72E-07
17,333	6.03E-08	8.97E-11	2.20E-08	5.96E-08	4.63E-13	1.42E-07
21,667	4.66E-08	5.08E-11	2.34E-08	6.04E-08	2.58E-13	1.30E-07

Table D.I.82: Annual effective doses from external exposure and committed effective doses from yearly intake in the 1st year of operation, calculated from the design levels of discharges from the 2 Temelín units, approximately 1000 MWe each - children aged 2-7

Distance	Dose from the cloud	Committed dose from inhalation	Committed dose from inhalation	Committed dose from inhalation from resuspension	Committed dose from inhalation from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	7.44E-06	1.11E-09	1.27E-07	3.41E-07	3.30E-12	7.91E-06
1,333	2.09E-06	6.61E-10	1.07E-07	2.60E-07	1.98E-12	2.46E-06
2,333	1.27E-06	4.14E-10	7.76E-08	2.00E-07	1.24E-12	1.54E-06
3,333	7.40E-07	3.17E-10	5.67E-08	1.46E-07	9.49E-13	9.44E-07
4,333	4.99E-07	3.34E-10	4.43E-08	1.18E-07	1.01E-12	6.61E-07
5,333	3.64E-07	1.49E-10	3.68E-08	9.30E-08	4.43E-13	4.94E-07
6,333	2.81E-07	1.41E-10	3.18E-08	8.08E-08	4.23E-13	3.94E-07
7,333	2.25E-07	1.16E-10	2.82E-08	7.14E-08	3.47E-13	3.25E-07
8,667	1.75E-07	1.02E-10	2.47E-08	6.27E-08	3.08E-13	2.62E-07
10,667	1.27E-07	1.45E-10	2.10E-08	5.54E-08	4.41E-13	2.04E-07
12,667	9.78E-08	5.74E-11	1.83E-08	4.57E-08	1.73E-13	1.62E-07
14,667	7.81E-08	9.49E-11	1.62E-08	4.20E-08	2.87E-13	1.36E-07
17,333	6.03E-08	8.97E-11	1.40E-08	3.66E-08	2.70E-13	1.11E-07
21,667	4.66E-08	5.08E-11	1.48E-08	3.72E-08	1.50E-13	9.87E-08

Table D.I.83: Annual effective doses from external exposure and committed effective doses from annual intake in the 1st year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW$_e$ each - children aged 7-12

Distance	Cloud dose	Deposition dose	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	7.44E-06	1.11E-09	7.92E-08	3.14E-07	1.68E-12	7.83E-06
1,333	2.09E-06	6.61E-10	6.67E-08	2.42E-07	1.01E-12	2.40E-06
2,333	1.27E-06	4.14E-10	4.85E-08	1.87E-07	6.28E-13	1.50E-06
3,333	7.40E-07	3.17E-10	3.54E-08	1.37E-07	4.82E-13	9.13E-07

4,333	4.99E-07	3.34E-10	2.77E-08	1.09E-07	5.12E-13	6.35E-07
5,333	3.64E-07	1.49E-10	2.30E-08	8.77E-08	2.25E-13	4.75E-07
6,333	2.81E-07	1.41E-10	1.99E-08	7.61E-08	2.15E-13	3.77E-07
7,333	2.25E-07	1.16E-10	1.76E-08	6.74E-08	1.77E-13	3.10E-07
8,667	1.75E-07	1.02E-10	1.55E-08	5.91E-08	1.57E-13	2.49E-07
10,667	1.27E-07	1.45E-10	1.31E-08	5.14E-08	2.24E-13	1.92E-07
12,667	9.78E-08	5.74E-11	1.14E-08	4.33E-08	8.78E-14	1.53E-07
14,667	7.81E-08	9.49E-11	1.01E-08	3.92E-08	1.46E-13	1.28E-07
17,333	6.03E-08	8.97E-11	8.75E-09	3.41E-08	1.37E-13	1.03E-07
21,667	4.66E-08	5.08E-11	9.27E-09	3.53E-08	7.65E-14	9.12E-08

Table D.I.84: Annual effective doses from external exposure and committed effective doses from annual intake in the 1st year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each - children aged 12-17

Distance	Cloud dose	Deposition dose	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	7.44E-06	1.11E-09	1.24E-07	2.38E-07	2.17E-12	7.80E-06
1,333	2.09E-06	6.61E-10	1.04E-07	1.84E-07	1.30E-12	2.38E-06
2,333	1.27E-06	4.14E-10	7.56E-08	1.43E-07	8.13E-13	1.48E-06
3,333	7.40E-07	3.17E-10	5.52E-08	1.04E-07	6.24E-13	9.00E-07
4,333	4.99E-07	3.34E-10	4.32E-08	8.27E-08	6.62E-13	6.25E-07
5,333	3.64E-07	1.49E-10	3.58E-08	6.71E-08	2.92E-13	4.68E-07
6,333	2.81E-07	1.41E-10	3.10E-08	5.81E-08	2.78E-13	3.70E-07
7,333	2.25E-07	1.16E-10	2.75E-08	5.15E-08	2.28E-13	3.04E-07
8,667	1.75E-07	1.02E-10	2.41E-08	4.52E-08	2.02E-13	2.44E-07
10,667	1.27E-07	1.45E-10	2.05E-08	3.91E-08	2.90E-13	1.87E-07
12,667	9.78E-08	5.74E-11	1.78E-08	3.32E-08	1.14E-13	1.49E-07
14,667	7.81E-08	9.49E-11	1.58E-08	2.99E-08	1.89E-13	1.24E-07
17,333	6.03E-08	8.97E-11	1.36E-08	2.60E-08	1.78E-13	1.00E-07
21,667	4.66E-08	5.08E-11	1.45E-08	2.70E-08	9.90E-14	8.81E-08

Table D.I.85: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) - adults

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.28E-09	1.56E-07	2.14E-07	1.92E-12	7.81E-06	3.72E-08	1.56E-04
1,333	2.09E-06	1.27E-09	1.31E-07	1.66E-07	1.15E-12	2.39E-06	2.10E-08	4.78E-05
2,333	1.27E-06	8.12E-10	9.56E-08	1.29E-07	7.21E-13	1.49E-06	1.34E-08	2.98E-05
3,333	7.40E-07	6.11E-10	6.98E-08	9.45E-08	5.54E-13	9.05E-07	1.01E-08	1.81E-05
4,333	4.99E-07	6.21E-10	5.46E-08	7.44E-08	5.87E-13	6.28E-07	1.04E-08	1.26E-05
5,333	3.64E-07	3.00E-10	4.53E-08	6.09E-08	2.59E-13	4.71E-07	4.91E-09	9.42E-06
6,333	2.81E-07	2.77E-10	3.92E-08	5.27E-08	2.47E-13	3.73E-07	4.56E-09	7.47E-06
7,333	2.25E-07	2.27E-10	3.48E-08	4.68E-08	2.03E-13	3.07E-07	3.75E-09	6.14E-06
8,667	1.75E-07	1.99E-10	3.05E-08	4.10E-08	1.80E-13	2.46E-07	3.28E-09	4.93E-06
10,667	1.27E-07	2.72E-10	2.59E-08	3.52E-08	2.57E-13	1.89E-07	4.53E-09	3.77E-06
12,667	9.78E-08	1.15E-10	2.25E-08	3.02E-08	1.01E-13	1.51E-07	1.89E-09	3.01E-06
14,667	7.81E-08	1.85E-10	1.99E-08	2.70E-08	1.68E-13	1.25E-07	3.05E-09	2.50E-06
17,333	6.03E-08	1.84E-10	1.73E-08	2.34E-08	1.58E-13	1.01E-07	3.01E-09	2.02E-06
21,667	4.66E-08	1.18E-10	1.83E-08	2.46E-08	8.79E-14	8.96E-08	1.88E-09	1.79E-06

Table D.I.86: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MWe each (year 2020) - children aged 0-1

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.28E-09	6.83E-08	2.56E-07	1.75E-12	7.77E-06	3.72E-08	1.55E-04
1,333	2.09E-06	1.27E-09	5.78E-08	2.00E-07	1.05E-12	2.35E-06	2.10E-08	4.70E-05
2,333	1.27E-06	8.12E-10	4.18E-08	1.55E-07	6.57E-13	1.46E-06	1.34E-08	2.93E-05
3,333	7.40E-07	6.11E-10	3.05E-08	1.13E-07	5.05E-13	8.85E-07	1.01E-08	1.77E-05
4,333	4.99E-07	6.21E-10	2.39E-08	8.91E-08	5.35E-13	6.12E-07	1.04E-08	1.22E-05
5,333	3.64E-07	3.00E-10	1.98E-08	7.31E-08	2.36E-13	4.58E-07	4.91E-09	9.15E-06
6,333	2.81E-07	2.77E-10	1.71E-08	6.32E-08	2.25E-13	3.62E-07	4.56E-09	7.23E-06
7,333	2.25E-07	2.27E-10	1.52E-08	5.61E-08	1.85E-13	2.97E-07	3.75E-09	5.93E-06
8,667	1.75E-07	1.99E-10	1.33E-08	4.92E-08	1.64E-13	2.37E-07	3.28E-09	4.75E-06
10,667	1.27E-07	2.72E-10	1.13E-08	4.22E-08	2.34E-13	1.81E-07	4.53E-09	3.62E-06
12,667	9.78E-08	1.15E-10	9.85E-09	3.63E-08	9.18E-14	1.44E-07	1.89E-09	2.88E-06
14,667	7.81E-08	1.85E-10	8.72E-09	3.24E-08	1.53E-13	1.19E-07	3.05E-09	2.39E-06
17,333	6.03E-08	1.84E-10	7.54E-09	2.81E-08	1.44E-13	9.61E-08	3.01E-09	1.92E-06
21,667	4.66E-08	1.18E-10	7.99E-09	2.95E-08	8.00E-14	8.42E-08	1.88E-09	1.68E-06

Table D.I.87: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) - children aged 1-2

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.28E-09	2.00E-07	5.58E-07	5.65E-12	8.20E-06	3.72E-08	1.64E-04
1,333	2.09E-06	1.27E-09	1.69E-07	4.24E-07	3.39E-12	2.69E-06	2.10E-08	5.37E-05
2,333	1.27E-06	8.12E-10	1.22E-07	3.25E-07	2.12E-12	1.71E-06	1.34E-08	3.43E-05
3,333	7.40E-07	6.11E-10	8.93E-08	2.38E-07	1.63E-12	1.07E-06	1.01E-08	2.14E-05
4,333	4.99E-07	6.21E-10	6.98E-08	1.92E-07	1.73E-12	7.61E-07	1.04E-08	1.52E-05
5,333	3.64E-07	3.00E-10	5.79E-08	1.51E-07	7.60E-13	5.74E-07	4.91E-09	1.15E-05
6,333	2.81E-07	2.77E-10	5.01E-08	1.31E-07	7.26E-13	4.63E-07	4.56E-09	9.25E-06
7,333	2.25E-07	2.27E-10	4.45E-08	1.16E-07	5.96E-13	3.86E-07	3.75E-09	7.71E-06
8,667	1.75E-07	1.99E-10	3.90E-08	1.02E-07	5.28E-13	3.16E-07	3.28E-09	6.31E-06
10,667	1.27E-07	2.72E-10	3.31E-08	9.02E-08	7.56E-13	2.51E-07	4.53E-09	5.02E-06
12,667	9.78E-08	1.15E-10	2.88E-08	7.41E-08	2.96E-13	2.01E-07	1.89E-09	4.02E-06
14,667	7.81E-08	1.85E-10	2.55E-08	6.84E-08	4.93E-13	1.72E-07	3.05E-09	3.44E-06
17,333	6.03E-08	1.84E-10	2.20E-08	5.97E-08	4.63E-13	1.42E-07	3.01E-09	2.84E-06
21,667	4.66E-08	1.18E-10	2.34E-08	6.04E-08	2.58E-13	1.30E-07	1.88E-09	2.61E-06

Table D.I.88: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) – children aged 2-7

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.28E-09	1.27E-07	3.41E-07	3.30E-12	7.91E-06	3.72E-08	1.58E-04
1,333	2.09E-06	1.27E-09	1.07E-07	2.60E-07	1.98E-12	2.46E-06	2.10E-08	4.92E-05
2,333	1.27E-06	8.12E-10	7.76E-08	2.00E-07	1.24E-12	1.54E-06	1.34E-08	3.09E-05
3,333	7.40E-07	6.11E-10	5.67E-08	1.46E-07	9.49E-13	9.44E-07	1.01E-08	1.89E-05
4,333	4.99E-07	6.21E-10	4.43E-08	1.18E-07	1.01E-12	6.61E-07	1.04E-08	1.32E-05
5,333	3.64E-07	3.00E-10	3.68E-08	9.30E-08	4.43E-13	4.95E-07	4.91E-09	9.89E-06
6,333	2.81E-07	2.77E-10	3.18E-08	8.08E-08	4.23E-13	3.94E-07	4.56E-09	7.88E-06
7,333	2.25E-07	2.27E-10	2.82E-08	7.15E-08	3.47E-13	3.25E-07	3.75E-09	6.50E-06
8,667	1.75E-07	1.99E-10	2.47E-08	6.27E-08	3.08E-13	2.62E-07	3.28E-09	5.25E-06
10,667	1.27E-07	2.72E-10	2.10E-08	5.54E-08	4.41E-13	2.04E-07	4.53E-09	4.08E-06
12,667	9.78E-08	1.15E-10	1.83E-08	4.57E-08	1.73E-13	1.62E-07	1.89E-09	3.24E-06
14,667	7.81E-08	1.85E-10	1.62E-08	4.20E-08	2.87E-13	1.36E-07	3.05E-09	2.73E-06
17,333	6.03E-08	1.84E-10	1.40E-08	3.66E-08	2.70E-13	1.11E-07	3.01E-09	2.22E-06
21,667	4.66E-08	1.18E-10	1.48E-08	3.73E-08	1.50E-13	9.88E-08	1.88E-09	1.97E-06

Table D.I.89: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) – children aged 7-12 years

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.28E-09	7.92E-08	3.14E-07	1.68E-12	7.84E-06	3.72E-08	1.57E-04
1,333	2.09E-06	1.27E-09	6.67E-08	2.42E-07	1.01E-12	2.40E-06	2.10E-08	4.80E-05
2,333	1.27E-06	8.12E-10	4.85E-08	1.87E-07	6.28E-13	1.50E-06	1.34E-08	3.00E-05
3,333	7.40E-07	6.11E-10	3.54E-08	1.37E-07	4.82E-13	9.13E-07	1.01E-08	1.83E-05
4,333	4.99E-07	6.21E-10	2.77E-08	1.09E-07	5.12E-13	6.36E-07	1.04E-08	1.27E-05
5,333	3.64E-07	3.00E-10	2.30E-08	8.77E-08	2.25E-13	4.75E-07	4.91E-09	9.51E-06
6,333	2.81E-07	2.77E-10	1.99E-08	7.61E-08	2.15E-13	3.77E-07	4.56E-09	7.55E-06
7,333	2.25E-07	2.27E-10	1.76E-08	6.74E-08	1.77E-13	3.10E-07	3.75E-09	6.21E-06
8,667	1.75E-07	1.99E-10	1.55E-08	5.91E-08	1.57E-13	2.49E-07	3.28E-09	4.99E-06
10,667	1.27E-07	2.72E-10	1.31E-08	5.14E-08	2.24E-13	1.92E-07	4.53E-09	3.84E-06
12,667	9.78E-08	1.15E-10	1.14E-08	4.33E-08	8.78E-14	1.53E-07	1.89E-09	3.05E-06
14,667	7.81E-08	1.85E-10	1.01E-08	3.92E-08	1.46E-13	1.28E-07	3.05E-09	2.55E-06
17,333	6.03E-08	1.84E-10	8.75E-09	3.41E-08	1.37E-13	1.03E-07	3.01E-09	2.07E-06
21,667	4.66E-08	1.18E-10	9.27E-09	3.53E-08	7.65E-14	9.12E-08	1.88E-09	1.82E-06

Table D.I.90: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) - children aged 12-17

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.28E-09	1.24E-07	2.38E-07	2.17E-12	7.80E-06	3.72E-08	1.56E-04
1,333	2.09E-06	1.27E-09	1.04E-07	1.84E-07	1.30E-12	2.38E-06	2.10E-08	4.76E-05
2,333	1.27E-06	8.12E-10	7.56E-08	1.43E-07	8.13E-13	1.48E-06	1.34E-08	2.97E-05
3,333	7.40E-07	6.11E-10	5.52E-08	1.04E-07	6.24E-13	9.01E-07	1.01E-08	1.80E-05
4,333	4.99E-07	6.21E-10	4.32E-08	8.27E-08	6.62E-13	6.25E-07	1.04E-08	1.25E-05
5,333	3.64E-07	3.00E-10	3.58E-08	6.71E-08	2.92E-13	4.68E-07	4.91E-09	9.35E-06
6,333	2.81E-07	2.77E-10	3.10E-08	5.81E-08	2.78E-13	3.71E-07	4.56E-09	7.41E-06
7,333	2.25E-07	2.27E-10	2.75E-08	5.15E-08	2.28E-13	3.04E-07	3.75E-09	6.09E-06
8,667	1.75E-07	1.99E-10	2.41E-08	4.52E-08	2.02E-13	2.44E-07	3.28E-09	4.88E-06
10,667	1.27E-07	2.72E-10	2.05E-08	3.91E-08	2.90E-13	1.87E-07	4.53E-09	3.74E-06
12,667	9.78E-08	1.15E-10	1.78E-08	3.32E-08	1.14E-13	1.49E-07	1.89E-09	2.98E-06
14,667	7.81E-08	1.85E-10	1.58E-08	2.99E-08	1.89E-13	1.24E-07	3.05E-09	2.48E-06
17,333	6.03E-08	1.84E-10	1.36E-08	2.60E-08	1.78E-13	1.00E-07	3.01E-09	2.00E-06
21,667	4.66E-08	1.18E-10	1.45E-08	2.70E-08	9.90E-14	8.82E-08	1.88E-09	1.76E-06

Table D.I.91: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - adults

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.65E-09	1.56E-07	2.14E-07	1.92E-12	7.81E-06	1.13E-07	3.91E-04
1,333	2.09E-06	1.46E-09	1.31E-07	1.66E-07	1.15E-12	2.39E-06	6.28E-08	1.20E-04
2,333	1.27E-06	9.38E-10	9.56E-08	1.29E-07	7.21E-13	1.49E-06	4.02E-08	7.45E-05
3,333	7.40E-07	7.05E-10	6.98E-08	9.45E-08	5.54E-13	9.05E-07	3.03E-08	4.53E-05
4,333	4.99E-07	7.12E-10	5.46E-08	7.44E-08	5.87E-13	6.28E-07	3.08E-08	3.14E-05
5,333	3.64E-07	3.48E-10	4.53E-08	6.09E-08	2.59E-13	4.71E-07	1.49E-08	2.36E-05
6,333	2.81E-07	3.20E-10	3.92E-08	5.27E-08	2.47E-13	3.73E-07	1.37E-08	1.87E-05
7,333	2.25E-07	2.63E-10	3.48E-08	4.68E-08	2.03E-13	3.07E-07	1.13E-08	1.53E-05
8,667	1.75E-07	2.29E-10	3.05E-08	4.10E-08	1.80E-13	2.46E-07	9.85E-09	1.23E-05
10,667	1.27E-07	3.12E-10	2.59E-08	3.52E-08	2.57E-13	1.89E-07	1.35E-08	9.43E-06
12,667	9.78E-08	1.33E-10	2.25E-08	3.02E-08	1.01E-13	1.51E-07	5.70E-09	7.53E-06
14,667	7.81E-08	2.13E-10	1.99E-08	2.70E-08	1.68E-13	1.25E-07	9.15E-09	6.26E-06
17,333	6.03E-08	2.15E-10	1.73E-08	2.34E-08	1.58E-13	1.01E-07	9.13E-09	5.06E-06
21,667	4.66E-08	1.40E-10	1.83E-08	2.46E-08	8.79E-14	8.96E-08	5.85E-09	4.48E-06

Table D.I.92: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - children aged 0-1

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.65E-09	6.83E-08	2.56E-07	1.75E-12	7.77E-06	1.13E-07	3.88E-04
1,333	2.09E-06	1.46E-09	5.78E-08	2.00E-07	1.05E-12	2.35E-06	6.28E-08	1.18E-04
2,333	1.27E-06	9.38E-10	4.18E-08	1.55E-07	6.57E-13	1.46E-06	4.02E-08	7.31E-05
3,333	7.40E-07	7.05E-10	3.05E-08	1.13E-07	5.05E-13	8.85E-07	3.03E-08	4.42E-05
4,333	4.99E-07	7.12E-10	2.39E-08	8.91E-08	5.35E-13	6.12E-07	3.08E-08	3.06E-05
5,333	3.64E-07	3.48E-10	1.98E-08	7.31E-08	2.36E-13	4.58E-07	1.49E-08	2.29E-05
6,333	2.81E-07	3.20E-10	1.71E-08	6.32E-08	2.25E-13	3.62E-07	1.37E-08	1.81E-05
7,333	2.25E-07	2.63E-10	1.52E-08	5.61E-08	1.85E-13	2.97E-07	1.13E-08	1.48E-05
8,667	1.75E-07	2.29E-10	1.33E-08	4.92E-08	1.64E-13	2.37E-07	9.85E-09	1.19E-05
10,667	1.27E-07	3.12E-10	1.13E-08	4.22E-08	2.34E-13	1.81E-07	1.35E-08	9.05E-06
12,667	9.78E-08	1.33E-10	9.85E-09	3.63E-08	9.18E-14	1.44E-07	5.70E-09	7.20E-06
14,667	7.81E-08	2.13E-10	8.72E-09	3.24E-08	1.53E-13	1.19E-07	9.15E-09	5.97E-06
17,333	6.03E-08	2.15E-10	7.54E-09	2.81E-08	1.44E-13	9.61E-08	9.13E-09	4.80E-06
21,667	4.66E-08	1.40E-10	7.99E-09	2.95E-08	8.00E-14	8.42E-08	5.85E-09	4.21E-06

Table D.I.93: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - children aged 1-2

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.65E-09	2.00E-07	5.58E-07	5.65E-12	8.20E-06	1.13E-07	4.10E-04
1,333	2.09E-06	1.46E-09	1.69E-07	4.24E-07	3.39E-12	2.69E-06	6.28E-08	1.34E-04
2,333	1.27E-06	9.38E-10	1.22E-07	3.25E-07	2.12E-12	1.71E-06	4.02E-08	8.57E-05
3,333	7.40E-07	7.05E-10	8.93E-08	2.38E-07	1.63E-12	1.07E-06	3.03E-08	5.34E-05
4,333	4.99E-07	7.12E-10	6.98E-08	1.92E-07	1.73E-12	7.61E-07	3.08E-08	3.80E-05
5,333	3.64E-07	3.48E-10	5.79E-08	1.51E-07	7.60E-13	5.74E-07	1.49E-08	2.87E-05
6,333	2.81E-07	3.20E-10	5.01E-08	1.31E-07	7.26E-13	4.63E-07	1.37E-08	2.31E-05
7,333	2.25E-07	2.63E-10	4.45E-08	1.16E-07	5.96E-13	3.86E-07	1.13E-08	1.93E-05
8,667	1.75E-07	2.29E-10	3.90E-08	1.02E-07	5.28E-13	3.16E-07	9.85E-09	1.58E-05
10,667	1.27E-07	3.12E-10	3.31E-08	9.02E-08	7.56E-13	2.51E-07	1.35E-08	1.25E-05
12,667	9.78E-08	1.33E-10	2.88E-08	7.41E-08	2.96E-13	2.01E-07	5.70E-09	1.00E-05
14,667	7.81E-08	2.13E-10	2.55E-08	6.84E-08	4.93E-13	1.72E-07	9.15E-09	8.61E-06
17,333	6.03E-08	2.15E-10	2.20E-08	5.97E-08	4.63E-13	1.42E-07	9.13E-09	7.11E-06
21,667	4.66E-08	1.40E-10	2.34E-08	6.04E-08	2.58E-13	1.30E-07	5.85E-09	6.52E-06

Table D.I.94: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW$_e$ each (year 2050) - children aged 2-7

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.65E-09	1.27E-07	3.41E-07	3.30E-12	7.91E-06	1.13E-07	3.96E-04
1,333	2.09E-06	1.46E-09	1.07E-07	2.60E-07	1.98E-12	2.46E-06	6.28E-08	1.23E-04
2,333	1.27E-06	9.38E-10	7.76E-08	2.00E-07	1.24E-12	1.54E-06	4.02E-08	7.72E-05
3,333	7.40E-07	7.05E-10	5.67E-08	1.46E-07	9.49E-13	9.44E-07	3.03E-08	4.72E-05
4,333	4.99E-07	7.12E-10	4.43E-08	1.18E-07	1.01E-12	6.61E-07	3.08E-08	3.31E-05
5,333	3.64E-07	3.48E-10	3.68E-08	9.30E-08	4.43E-13	4.95E-07	1.49E-08	2.47E-05
6,333	2.81E-07	3.20E-10	3.18E-08	8.08E-08	4.23E-13	3.94E-07	1.37E-08	1.97E-05
7,333	2.25E-07	2.63E-10	2.82E-08	7.15E-08	3.47E-13	3.25E-07	1.13E-08	1.63E-05
8,667	1.75E-07	2.29E-10	2.47E-08	6.27E-08	3.08E-13	2.62E-07	9.85E-09	1.31E-05
10,667	1.27E-07	3.12E-10	2.10E-08	5.54E-08	4.41E-13	2.04E-07	1.35E-08	1.02E-05
12,667	9.78E-08	1.33E-10	1.83E-08	4.57E-08	1.73E-13	1.62E-07	5.70E-09	8.10E-06
14,667	7.81E-08	2.13E-10	1.62E-08	4.20E-08	2.87E-13	1.37E-07	9.15E-09	6.82E-06
17,333	6.03E-08	2.15E-10	1.40E-08	3.66E-08	2.70E-13	1.11E-07	9.13E-09	5.56E-06
21,667	4.66E-08	1.40E-10	1.48E-08	3.73E-08	1.50E-13	9.88E-08	5.85E-09	4.94E-06

Table D.I.95: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW$_e$ each (year 2050) - children aged 7-12

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.65E-09	7.92E-08	3.14E-07	1.68E-12	7.84E-06	1.13E-07	3.92E-04
1,333	2.09E-06	1.46E-09	6.67E-08	2.42E-07	1.01E-12	2.40E-06	6.28E-08	1.20E-04
2,333	1.27E-06	9.38E-10	4.85E-08	1.87E-07	6.28E-13	1.50E-06	4.02E-08	7.51E-05
3,333	7.40E-07	7.05E-10	3.54E-08	1.37E-07	4.82E-13	9.13E-07	3.03E-08	4.57E-05
4,333	4.99E-07	7.12E-10	2.77E-08	1.09E-07	5.12E-13	6.36E-07	3.08E-08	3.18E-05
5,333	3.64E-07	3.48E-10	2.30E-08	8.77E-08	2.25E-13	4.76E-07	1.49E-08	2.38E-05
6,333	2.81E-07	3.20E-10	1.99E-08	7.61E-08	2.15E-13	3.77E-07	1.37E-08	1.89E-05
7,333	2.25E-07	2.63E-10	1.76E-08	6.74E-08	1.77E-13	3.10E-07	1.13E-08	1.55E-05
8,667	1.75E-07	2.29E-10	1.55E-08	5.91E-08	1.57E-13	2.49E-07	9.85E-09	1.25E-05
10,667	1.27E-07	3.12E-10	1.31E-08	5.14E-08	2.24E-13	1.92E-07	1.35E-08	9.60E-06
12,667	9.78E-08	1.33E-10	1.14E-08	4.33E-08	8.78E-14	1.53E-07	5.70E-09	7.63E-06
14,667	7.81E-08	2.13E-10	1.01E-08	3.92E-08	1.46E-13	1.28E-07	9.15E-09	6.38E-06
17,333	6.03E-08	2.15E-10	8.75E-09	3.41E-08	1.37E-13	1.03E-07	9.13E-09	5.17E-06
21,667	4.66E-08	1.40E-10	9.27E-09	3.53E-08	7.65E-14	9.12E-08	5.85E-09	4.56E-06

Table D.I.96: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from design values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - children aged 12-17

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	7.44E-06	2.65E-09	1.24E-07	2.38E-07	2.17E-12	7.80E-06	1.13E-07	3.90E-04
1,333	2.09E-06	1.46E-09	1.04E-07	1.84E-07	1.30E-12	2.38E-06	6.28E-08	1.19E-04
2,333	1.27E-06	9.38E-10	7.56E-08	1.43E-07	8.13E-13	1.48E-06	4.02E-08	7.42E-05
3,333	7.40E-07	7.05E-10	5.52E-08	1.04E-07	6.24E-13	9.01E-07	3.03E-08	4.50E-05
4,333	4.99E-07	7.12E-10	4.32E-08	8.27E-08	6.62E-13	6.25E-07	3.08E-08	3.13E-05
5,333	3.64E-07	3.48E-10	3.58E-08	6.71E-08	2.92E-13	4.68E-07	1.49E-08	2.34E-05
6,333	2.81E-07	3.20E-10	3.10E-08	5.81E-08	2.78E-13	3.71E-07	1.37E-08	1.85E-05
7,333	2.25E-07	2.63E-10	2.75E-08	5.15E-08	2.28E-13	3.04E-07	1.13E-08	1.52E-05
8,667	1.75E-07	2.29E-10	2.41E-08	4.52E-08	2.02E-13	2.44E-07	9.85E-09	1.22E-05
10,667	1.27E-07	3.12E-10	2.05E-08	3.91E-08	2.90E-13	1.87E-07	1.35E-08	9.35E-06
12,667	9.78E-08	1.33E-10	1.78E-08	3.32E-08	1.14E-13	1.49E-07	5.70E-09	7.45E-06
14,667	7.81E-08	2.13E-10	1.58E-08	2.99E-08	1.89E-13	1.24E-07	9.15E-09	6.20E-06
17,333	6.03E-08	2.15E-10	1.36E-08	2.60E-08	1.78E-13	1.00E-07	9.13E-09	5.01E-06
21,667	4.66E-08	1.40E-10	1.45E-08	2.70E-08	9.90E-14	8.82E-08	5.85E-09	4.41E-06

Information on doses calculated from measured (operating) values of discharges is included in the following tables:

Table D.I.97: Annual effective doses from external exposure and committed effective doses from annual intake in the 1st year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each - adults

Distance	Cloud dose	Deposition dose	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.53E-07	2.89E-10	6.35E-08	1.68E-07	1.10E-12	3.85E-07
1,333	4.25E-08	1.71E-10	5.08E-08	1.31E-07	6.17E-13	2.24E-07
2,333	2.56E-08	1.07E-10	3.89E-08	1.03E-07	3.94E-13	1.67E-07
3,333	1.48E-08	8.16E-11	2.84E-08	7.49E-08	2.98E-13	1.18E-07
4,333	9.92E-09	8.56E-11	2.22E-08	5.88E-08	3.04E-13	9.10E-08
5,333	7.19E-09	3.87E-11	1.84E-08	4.85E-08	1.45E-13	7.42E-08
6,333	5.50E-09	3.66E-11	1.59E-08	4.20E-08	1.35E-13	6.34E-08
7,333	4.38E-09	3.00E-11	1.41E-08	3.72E-08	1.11E-13	5.58E-08
8,667	3.36E-09	2.65E-11	1.24E-08	3.27E-08	9.70E-14	4.84E-08
10,667	2.42E-09	3.75E-11	1.05E-08	2.79E-08	1.34E-13	4.08E-08
12,667	1.83E-09	1.50E-11	9.17E-09	2.41E-08	5.60E-14	3.51E-08
14,667	1.44E-09	2.48E-11	8.11E-09	2.14E-08	9.05E-14	3.10E-08
17,333	1.10E-09	2.37E-11	7.02E-09	1.86E-08	8.96E-14	2.67E-08
21,667	8.18E-10	1.38E-11	7.44E-09	1.96E-08	5.64E-14	2.79E-08

Table D.I.98: Annual effective doses from external exposure and committed effective doses from annual intake in the 1st year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each - children aged 0-1

Distance	Cloud dose	Deposition dose	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.53E-07	2.89E-10	2.41E-08	1.98E-07	6.21E-13	3.75E-07
1,333	4.25E-08	1.71E-10	1.94E-08	1.54E-07	3.65E-13	2.16E-07
2,333	2.56E-08	1.07E-10	1.48E-08	1.20E-07	2.30E-13	1.61E-07
3,333	1.48E-08	8.16E-11	1.08E-08	8.80E-08	1.75E-13	1.14E-07
4,333	9.92E-09	8.56E-11	8.43E-09	6.90E-08	1.84E-13	8.75E-08
5,333	7.19E-09	3.87E-11	6.99E-09	5.70E-08	8.31E-14	7.12E-08
6,333	5.50E-09	3.66E-11	6.04E-09	4.93E-08	7.86E-14	6.09E-08
7,333	4.38E-09	3.00E-11	5.37E-09	4.37E-08	6.45E-14	5.35E-08
8,667	3.36E-09	2.65E-11	4.71E-09	3.84E-08	5.70E-14	4.65E-08
10,667	2.42E-09	3.75E-11	4.00E-09	3.27E-08	8.08E-14	3.92E-08
12,667	1.83E-09	1.50E-11	3.48E-09	2.83E-08	3.23E-14	3.37E-08
14,667	1.44E-09	2.48E-11	3.08E-09	2.52E-08	5.33E-14	2.97E-08
17,333	1.10E-09	2.37E-11	2.66E-09	2.18E-08	5.09E-14	2.56E-08
21,667	8.18E-10	1.38E-11	2.82E-09	2.30E-08	2.95E-14	2.67E-08

Table D.I.99: Annual effective doses from external exposure and committed effective doses from annual intake in the 1st year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each - children aged 1-2

Distance	Cloud dose	Deposition dose	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.53E-07	2.89E-10	7.26E-08	4.15E-07	2.01E-12	6.41E-07
1,333	4.25E-08	1.71E-10	5.84E-08	3.19E-07	1.18E-12	4.21E-07
2,333	2.56E-08	1.07E-10	4.44E-08	2.49E-07	7.43E-13	3.19E-07
3,333	1.48E-08	8.16E-11	3.25E-08	1.82E-07	5.68E-13	2.29E-07
4,333	9.92E-09	8.56E-11	2.54E-08	1.44E-07	5.96E-13	1.80E-07
5,333	7.19E-09	3.87E-11	2.11E-08	1.17E-07	2.69E-13	1.45E-07
6,333	5.50E-09	3.66E-11	1.82E-08	1.01E-07	2.54E-13	1.25E-07
7,333	4.38E-09	3.00E-11	1.62E-08	8.98E-08	2.09E-13	1.10E-07
8,667	3.36E-09	2.65E-11	1.42E-08	7.88E-08	1.85E-13	9.63E-08
10,667	2.42E-09	3.75E-11	1.20E-08	6.81E-08	2.61E-13	8.26E-08
12,667	1.83E-09	1.50E-11	1.05E-08	5.79E-08	1.04E-13	7.02E-08
14,667	1.44E-09	2.48E-11	9.27E-09	5.21E-08	1.72E-13	6.29E-08
17,333	1.10E-09	2.37E-11	8.02E-09	4.53E-08	1.65E-13	5.44E-08
21,667	8.18E-10	1.38E-11	8.50E-09	4.71E-08	9.55E-14	5.64E-08

Table D.I.100: Annual effective doses from external exposure and committed effective doses from annual intake in the 1st year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each - children aged 2-7

Distance	Cloud dose	Deposition dose	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.53E-07	2.89E-10	4.66E-08	2.56E-07	1.23E-12	4.56E-07
1,333	4.25E-08	1.71E-10	3.75E-08	1.97E-07	7.21E-13	2.77E-07
2,333	2.56E-08	1.07E-10	2.85E-08	1.54E-07	4.54E-13	2.08E-07
3,333	1.48E-08	8.16E-11	2.08E-08	1.12E-07	3.47E-13	1.48E-07
4,333	9.92E-09	8.56E-11	1.63E-08	8.89E-08	3.63E-13	1.15E-07
5,333	7.19E-09	3.87E-11	1.35E-08	7.22E-08	1.65E-13	9.30E-08

6,333	5.50E-09	3.66E-11	1.17E-08	6.26E-08	1.55E-13	7.98E-08
7,333	4.38E-09	3.00E-11	1.04E-08	5.55E-08	1.28E-13	7.03E-08
8,667	3.36E-09	2.65E-11	9.10E-09	4.87E-08	1.13E-13	6.11E-08
10,667	2.42E-09	3.75E-11	7.73E-09	4.20E-08	1.59E-13	5.22E-08
12,667	1.83E-09	1.50E-11	6.73E-09	3.58E-08	6.39E-14	4.43E-08
14,667	1.44E-09	2.48E-11	5.95E-09	3.22E-08	1.05E-13	3.96E-08
17,333	1.10E-09	2.37E-11	5.15E-09	2.79E-08	1.01E-13	3.42E-08
21,667	8.18E-10	1.38E-11	5.46E-09	2.91E-08	5.91E-14	3.54E-08

Table D.I.101: Annual effective doses from external exposure and committed effective doses from annual intake in the 1st year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each - children aged 7-12

Distance	Cloud dose	Deposition dose	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.53E-07	2.89E-10	3.05E-08	2.43E-07	6.92E-13	4.27E-07
1,333	4.25E-08	1.71E-10	2.44E-08	1.88E-07	4.01E-13	2.55E-07
2,333	2.56E-08	1.07E-10	1.86E-08	1.47E-07	2.53E-13	1.91E-07
3,333	1.48E-08	8.16E-11	1.36E-08	1.07E-07	1.93E-13	1.36E-07
4,333	9.92E-09	8.56E-11	1.07E-08	8.46E-08	2.01E-13	1.05E-07
5,333	7.19E-09	3.87E-11	8.83E-09	6.94E-08	9.22E-14	8.54E-08
6,333	5.50E-09	3.66E-11	7.64E-09	6.00E-08	8.67E-14	7.32E-08
7,333	4.38E-09	3.00E-11	6.78E-09	5.33E-08	7.12E-14	6.44E-08
8,667	3.36E-09	2.65E-11	5.94E-09	4.67E-08	6.27E-14	5.60E-08
10,667	2.42E-09	3.75E-11	5.05E-09	4.00E-08	8.80E-14	4.75E-08
12,667	1.83E-09	1.50E-11	4.40E-09	3.44E-08	3.57E-14	4.07E-08
14,667	1.44E-09	2.48E-11	3.89E-09	3.07E-08	5.85E-14	3.61E-08
17,333	1.10E-09	2.37E-11	3.36E-09	2.67E-08	5.66E-14	3.11E-08
21,667	8.18E-10	1.38E-11	3.57E-09	2.80E-08	3.38E-14	3.24E-08

Table D.I.102: Annual effective doses from external exposure and committed effective doses from annual intake in the 1st year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each – children aged 12-17

Distance	Cloud dose	Deposition dose	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose total
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]
667	1.53E-07	2.89E-10	5.07E-08	1.85E-07	1.01E-12	3.89E-07
1,333	4.25E-08	1.71E-10	4.05E-08	1.43E-07	5.78E-13	2.27E-07
2,333	2.56E-08	1.07E-10	3.10E-08	1.12E-07	3.67E-13	1.69E-07
3,333	1.48E-08	8.16E-11	2.27E-08	8.21E-08	2.79E-13	1.20E-07
4,333	9.92E-09	8.56E-11	1.77E-08	6.45E-08	2.88E-13	9.22E-08
5,333	7.19E-09	3.87E-11	1.47E-08	5.30E-08	1.34E-13	7.50E-08
6,333	5.50E-09	3.66E-11	1.27E-08	4.59E-08	1.26E-13	6.41E-08
7,333	4.38E-09	3.00E-11	1.13E-08	4.07E-08	1.03E-13	5.64E-08
8,667	3.36E-09	2.65E-11	9.89E-09	3.57E-08	9.07E-14	4.90E-08
10,667	2.42E-09	3.75E-11	8.40E-09	3.05E-08	1.26E-13	4.14E-08
12,667	1.83E-09	1.50E-11	7.32E-09	2.63E-08	5.20E-14	3.55E-08
14,667	1.44E-09	2.48E-11	6.47E-09	2.35E-08	8.47E-14	3.14E-08
17,333	1.10E-09	2.37E-11	5.60E-09	2.03E-08	8.27E-14	2.71E-08
21,667	8.18E-10	1.38E-11	5.94E-09	2.14E-08	5.05E-14	2.82E-08

Table D.I.103: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) - adults

Distance	Cloud dose	Deposition dose in 20th year	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose	Annual eff. dose in 20th year	Integral deposition dose	Effective dose over 20 years

		of operation			from resuspension	of operation		of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	1.53E-07	5.31E-10	6.35E-08	1.68E-07	1.10E-12	3.85E-07	9.25E-09	7.71E-06
1,333	4.25E-08	3.24E-10	5.08E-08	1.31E-07	6.17E-13	2.24E-07	5.55E-09	4.49E-06
2,333	2.56E-08	1.89E-10	3.89E-08	1.03E-07	3.94E-13	1.67E-07	3.32E-09	3.34E-06
3,333	1.48E-08	1.43E-10	2.84E-08	7.50E-08	2.98E-13	1.18E-07	2.51E-09	2.37E-06
4,333	9.92E-09	1.45E-10	2.22E-08	5.88E-08	3.04E-13	9.11E-08	2.57E-09	1.82E-06
5,333	7.19E-09	7.00E-11	1.84E-08	4.85E-08	1.45E-13	7.42E-08	1.22E-09	1.48E-06
6,333	5.50E-09	6.48E-11	1.59E-08	4.20E-08	1.35E-13	6.35E-08	1.14E-09	1.27E-06
7,333	4.38E-09	5.32E-11	1.41E-08	3.72E-08	1.11E-13	5.58E-08	9.33E-10	1.12E-06
8,667	3.36E-09	4.66E-11	1.24E-08	3.27E-08	9.70E-14	4.85E-08	8.19E-10	9.69E-07
10,667	2.42E-09	6.39E-11	1.05E-08	2.79E-08	1.34E-13	4.09E-08	1.13E-09	8.17E-07
12,667	1.83E-09	2.70E-11	9.17E-09	2.41E-08	5.60E-14	3.51E-08	4.72E-10	7.03E-07
14,667	1.44E-09	4.34E-11	8.11E-09	2.14E-08	9.05E-14	3.10E-08	7.63E-10	6.20E-07
17,333	1.10E-09	4.33E-11	7.02E-09	1.86E-08	8.96E-14	2.67E-08	7.55E-10	5.34E-07
21,667	8.18E-10	2.77E-11	7.44E-09	1.96E-08	5.64E-14	2.79E-08	4.75E-10	5.58E-07

Table D.I.104: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) - children aged 0-1

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	1.53E-07	5.31E-10	2.41E-08	1.98E-07	6.21E-13	3.75E-07	9.25E-09	7.51E-06
1,333	4.25E-08	3.24E-10	1.94E-08	1.54E-07	3.65E-13	2.16E-07	5.55E-09	4.32E-06
2,333	2.56E-08	1.89E-10	1.48E-08	1.20E-07	2.30E-13	1.61E-07	3.32E-09	3.22E-06
3,333	1.48E-08	1.43E-10	1.08E-08	8.80E-08	1.75E-13	1.14E-07	2.51E-09	2.28E-06
4,333	9.92E-09	1.45E-10	8.43E-09	6.91E-08	1.84E-13	8.75E-08	2.57E-09	1.75E-06
5,333	7.19E-09	7.00E-11	6.99E-09	5.70E-08	8.31E-14	7.13E-08	1.22E-09	1.42E-06
6,333	5.50E-09	6.48E-11	6.04E-09	4.93E-08	7.86E-14	6.09E-08	1.14E-09	1.22E-06
7,333	4.38E-09	5.32E-11	5.37E-09	4.38E-08	6.45E-14	5.36E-08	9.33E-10	1.07E-06
8,667	3.36E-09	4.66E-11	4.71E-09	3.84E-08	5.70E-14	4.65E-08	8.19E-10	9.29E-07
10,667	2.42E-09	6.39E-11	4.00E-09	3.27E-08	8.08E-14	3.92E-08	1.13E-09	7.84E-07
12,667	1.83E-09	2.70E-11	3.48E-09	2.83E-08	3.23E-14	3.37E-08	4.72E-10	6.73E-07
14,667	1.44E-09	4.34E-11	3.08E-09	2.52E-08	5.33E-14	2.97E-08	7.63E-10	5.95E-07
17,333	1.10E-09	4.33E-11	2.66E-09	2.18E-08	5.09E-14	2.56E-08	7.55E-10	5.12E-07
21,667	8.18E-10	2.77E-11	2.82E-09	2.30E-08	2.95E-14	2.67E-08	4.75E-10	5.34E-07

Table D.I.105: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) - children aged 1-2

Distance	Cloud	Deposition	Committed	Committed	Committed	Annual	Integral	Effective

	dose	dose in 20th year of operation	inhalation dose	ingestion dose	inhalation dose from resuspension	eff. dose in 20th year of operation	deposition dose	dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	1.53E-07	5.31E-10	7.26E-08	4.15E-07	2.01E-12	6.41E-07	9.25E-09	1.28E-05
1,333	4.25E-08	3.24E-10	5.84E-08	3.19E-07	1.18E-12	4.21E-07	5.55E-09	8.41E-06
2,333	2.56E-08	1.89E-10	4.44E-08	2.49E-07	7.43E-13	3.19E-07	3.32E-09	6.38E-06
3,333	1.48E-08	1.43E-10	3.25E-08	1.82E-07	5.68E-13	2.30E-07	2.51E-09	4.59E-06
4,333	9.92E-09	1.45E-10	2.54E-08	1.44E-07	5.96E-13	1.80E-07	2.57E-09	3.59E-06
5,333	7.19E-09	7.00E-11	2.11E-08	1.17E-07	2.69E-13	1.45E-07	1.22E-09	2.91E-06
6,333	5.50E-09	6.48E-11	1.82E-08	1.01E-07	2.54E-13	1.25E-07	1.14E-09	2.50E-06
7,333	4.38E-09	5.32E-11	1.62E-08	8.98E-08	2.09E-13	1.10E-07	9.33E-10	2.21E-06
8,667	3.36E-09	4.66E-11	1.42E-08	7.88E-08	1.85E-13	9.64E-08	8.19E-10	1.93E-06
10,667	2.42E-09	6.39E-11	1.20E-08	6.81E-08	2.61E-13	8.27E-08	1.13E-09	1.65E-06
12,667	1.83E-09	2.70E-11	1.05E-08	5.79E-08	1.04E-13	7.02E-08	4.72E-10	1.40E-06
14,667	1.44E-09	4.34E-11	9.27E-09	5.22E-08	1.72E-13	6.29E-08	7.63E-10	1.26E-06
17,333	1.10E-09	4.33E-11	8.02E-09	4.53E-08	1.65E-13	5.44E-08	7.55E-10	1.09E-06
21,667	8.18E-10	2.77E-11	8.50E-09	4.71E-08	9.55E-14	5.64E-08	4.75E-10	1.13E-06

Table D.I.106: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) - children aged 2-7

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	1.53E-07	5.31E-10	4.66E-08	2.56E-07	1.23E-12	4.56E-07	9.25E-09	9.12E-06
1,333	4.25E-08	3.24E-10	3.75E-08	1.97E-07	7.21E-13	2.77E-07	5.55E-09	5.55E-06
2,333	2.56E-08	1.89E-10	2.85E-08	1.54E-07	4.54E-13	2.08E-07	3.32E-09	4.16E-06
3,333	1.48E-08	1.43E-10	2.08E-08	1.12E-07	3.47E-13	1.48E-07	2.51E-09	2.96E-06
4,333	9.92E-09	1.45E-10	1.63E-08	8.89E-08	3.63E-13	1.15E-07	2.57E-09	2.31E-06
5,333	7.19E-09	7.00E-11	1.35E-08	7.23E-08	1.65E-13	9.30E-08	1.22E-09	1.86E-06
6,333	5.50E-09	6.48E-11	1.17E-08	6.26E-08	1.55E-13	7.99E-08	1.14E-09	1.60E-06
7,333	4.38E-09	5.32E-11	1.04E-08	5.55E-08	1.28E-13	7.03E-08	9.33E-10	1.41E-06
8,667	3.36E-09	4.66E-11	9.10E-09	4.87E-08	1.13E-13	6.12E-08	8.19E-10	1.22E-06
10,667	2.42E-09	6.39E-11	7.73E-09	4.20E-08	1.59E-13	5.22E-08	1.13E-09	1.04E-06
12,667	1.83E-09	2.70E-11	6.73E-09	3.58E-08	6.39E-14	4.44E-08	4.72E-10	8.87E-07
14,667	1.44E-09	4.34E-11	5.95E-09	3.22E-08	1.05E-13	3.96E-08	7.63E-10	7.92E-07
17,333	1.10E-09	4.33E-11	5.15E-09	2.79E-08	1.01E-13	3.42E-08	7.55E-10	6.84E-07
21,667	8.18E-10	2.77E-11	5.46E-09	2.91E-08	5.91E-14	3.54E-08	4.75E-10	7.08E-07

Table D.I.107: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) - children aged 7-12

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	1.53E-07	5.31E-10	3.05E-08	2.43E-07	6.92E-13	4.27E-07	9.25E-09	8.54E-06
1,333	4.25E-08	3.24E-10	2.44E-08	1.88E-07	4.01E-13	2.55E-07	5.55E-09	5.10E-06
2,333	2.56E-08	1.89E-10	1.86E-08	1.47E-07	2.53E-13	1.91E-07	3.32E-09	3.83E-06
3,333	1.48E-08	1.43E-10	1.36E-08	1.07E-07	1.93E-13	1.36E-07	2.51E-09	2.72E-06
4,333	9.92E-09	1.45E-10	1.07E-08	8.46E-08	2.01E-13	1.05E-07	2.57E-09	2.11E-06
5,333	7.19E-09	7.00E-11	8.83E-09	6.94E-08	9.22E-14	8.55E-08	1.22E-09	1.71E-06
6,333	5.50E-09	6.48E-11	7.64E-09	6.00E-08	8.67E-14	7.32E-08	1.14E-09	1.46E-06
7,333	4.38E-09	5.32E-11	6.78E-09	5.33E-08	7.12E-14	6.45E-08	9.33E-10	1.29E-06
8,667	3.36E-09	4.66E-11	5.94E-09	4.67E-08	6.27E-14	5.61E-08	8.19E-10	1.12E-06
10,667	2.42E-09	6.39E-11	5.05E-09	4.01E-08	8.80E-14	4.76E-08	1.13E-09	9.51E-07
12,667	1.83E-09	2.70E-11	4.40E-09	3.44E-08	3.57E-14	4.07E-08	4.72E-10	8.13E-07
14,667	1.44E-09	4.34E-11	3.89E-09	3.07E-08	5.85E-14	3.61E-08	7.63E-10	7.22E-07
17,333	1.10E-09	4.33E-11	3.36E-09	2.67E-08	5.66E-14	3.12E-08	7.55E-10	6.23E-07
21,667	8.18E-10	2.77E-11	3.57E-09	2.80E-08	3.38E-14	3.24E-08	4.75E-10	6.48E-07

Table D.I.108: Annual effective doses from external exposure and committed effective doses from annual intake in the 20th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2020) - children aged 12-17

Distance	Cloud dose	Deposition dose in 20th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 20th year of operation	Integral deposition dose	Effective dose over 20 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/20 yrs]	[Sv/20 yrs]
667	1.53E-07	5.31E-10	5.07E-08	1.85E-07	1.01E-12	3.89E-07	9.25E-09	7.78E-06
1,333	4.25E-08	3.24E-10	4.05E-08	1.43E-07	5.78E-13	2.27E-07	5.55E-09	4.53E-06
2,333	2.56E-08	1.89E-10	3.10E-08	1.12E-07	3.67E-13	1.69E-07	3.32E-09	3.38E-06
3,333	1.48E-08	1.43E-10	2.27E-08	8.21E-08	2.79E-13	1.20E-07	2.51E-09	2.39E-06
4,333	9.92E-09	1.45E-10	1.77E-08	6.45E-08	2.88E-13	9.23E-08	2.57E-09	1.85E-06
5,333	7.19E-09	7.00E-11	1.47E-08	5.30E-08	1.34E-13	7.50E-08	1.22E-09	1.50E-06
6,333	5.50E-09	6.48E-11	1.27E-08	4.59E-08	1.26E-13	6.42E-08	1.14E-09	1.28E-06
7,333	4.38E-09	5.32E-11	1.13E-08	4.07E-08	1.03E-13	5.64E-08	9.33E-10	1.13E-06
8,667	3.36E-09	4.66E-11	9.89E-09	3.57E-08	9.07E-14	4.90E-08	8.19E-10	9.80E-07
10,667	2.42E-09	6.39E-11	8.40E-09	3.05E-08	1.26E-13	4.14E-08	1.13E-09	8.29E-07
12,667	1.83E-09	2.70E-11	7.32E-09	2.63E-08	5.20E-14	3.55E-08	4.72E-10	7.10E-07
14,667	1.44E-09	4.34E-11	6.47E-09	2.35E-08	8.47E-14	3.14E-08	7.63E-10	6.29E-07
17,333	1.10E-09	4.33E-11	5.60E-09	2.03E-08	8.27E-14	2.71E-08	7.55E-10	5.42E-07
21,667	8.18E-10	2.77E-11	5.94E-09	2.14E-08	5.05E-14	2.82E-08	4.75E-10	5.64E-07

Table D.I.109: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - adults

Distance	Cloud dose	Deposition dose in 50th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 50th year of operation	Integral deposition dose	Effective dose over 50 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/50 yrs]	[Sv/50 yrs]
667	1.53E-07	5.65E-10	6.35E-08	1.68E-07	1.10E-12	3.85E-07	2.59E-08	1.93E-05
1,333	4.25E-08	3.51E-10	5.08E-08	1.31E-07	6.17E-13	2.24E-07	1.58E-08	1.12E-05
2,333	2.56E-08	2.01E-10	3.89E-08	1.03E-07	3.94E-13	1.67E-07	9.24E-09	8.36E-06
3,333	1.48E-08	1.51E-10	2.84E-08	7.50E-08	2.98E-13	1.18E-07	6.97E-09	5.92E-06
4,333	9.92E-09	1.54E-10	2.22E-08	5.88E-08	3.04E-13	9.11E-08	7.10E-09	4.55E-06
5,333	7.19E-09	7.44E-11	1.84E-08	4.85E-08	1.45E-13	7.42E-08	3.41E-09	3.71E-06
6,333	5.50E-09	6.87E-11	1.59E-08	4.20E-08	1.35E-13	6.35E-08	3.16E-09	3.17E-06
7,333	4.38E-09	5.64E-11	1.41E-08	3.72E-08	1.11E-13	5.58E-08	2.60E-09	2.79E-06
8,667	3.36E-09	4.94E-11	1.24E-08	3.27E-08	9.70E-14	4.85E-08	2.27E-09	2.42E-06
10,667	2.42E-09	6.75E-11	1.05E-08	2.79E-08	1.34E-13	4.09E-08	3.12E-09	2.04E-06
12,667	1.83E-09	2.86E-11	9.17E-09	2.41E-08	5.60E-14	3.51E-08	1.32E-09	1.76E-06
14,667	1.44E-09	4.60E-11	8.11E-09	2.14E-08	9.05E-14	3.10E-08	2.12E-09	1.55E-06
17,333	1.10E-09	4.61E-11	7.02E-09	1.86E-08	8.96E-14	2.67E-08	2.11E-09	1.34E-06
21,667	8.18E-10	2.97E-11	7.44E-09	1.96E-08	5.64E-14	2.79E-08	1.35E-09	1.39E-06

Table D.I.110: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - children aged 0-1

Distance	Cloud dose	Deposition dose in 50th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 50th year of operation	Integral deposition dose	Effective dose over 50 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/50 yrs]	[Sv/50 yrs]
667	1.53E-07	5.65E-10	2.41E-08	1.98E-07	6.21E-13	3.75E-07	2.59E-08	1.88E-05
1,333	4.25E-08	3.51E-10	1.94E-08	1.54E-07	3.65E-13	2.16E-07	1.58E-08	1.08E-05
2,333	2.56E-08	2.01E-10	1.48E-08	1.20E-07	2.30E-13	1.61E-07	9.24E-09	8.05E-06
3,333	1.48E-08	1.51E-10	1.08E-08	8.80E-08	1.75E-13	1.14E-07	6.97E-09	5.69E-06
4,333	9.92E-09	1.54E-10	8.43E-09	6.91E-08	1.84E-13	8.76E-08	7.10E-09	4.38E-06
5,333	7.19E-09	7.44E-11	6.99E-09	5.70E-08	8.31E-14	7.13E-08	3.41E-09	3.56E-06
6,333	5.50E-09	6.87E-11	6.04E-09	4.93E-08	7.86E-14	6.09E-08	3.16E-09	3.05E-06
7,333	4.38E-09	5.64E-11	5.37E-09	4.38E-08	6.45E-14	5.36E-08	2.60E-09	2.68E-06
8,667	3.36E-09	4.94E-11	4.71E-09	3.84E-08	5.70E-14	4.65E-08	2.27E-09	2.32E-06
10,667	2.42E-09	6.75E-11	4.00E-09	3.27E-08	8.08E-14	3.92E-08	3.12E-09	1.96E-06
12,667	1.83E-09	2.86E-11	3.48E-09	2.83E-08	3.23E-14	3.37E-08	1.32E-09	1.68E-06
14,667	1.44E-09	4.60E-11	3.08E-09	2.52E-08	5.33E-14	2.97E-08	2.12E-09	1.49E-06
17,333	1.10E-09	4.61E-11	2.66E-09	2.18E-08	5.09E-14	2.56E-08	2.11E-09	1.28E-06
21,667	8.18E-10	2.97E-11	2.82E-09	2.30E-08	2.95E-14	2.67E-08	1.35E-09	1.33E-06

Table D.I.111: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - children aged 1-2

Distance	Cloud dose	Deposition dose in 50th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 50th year of operation	Integral deposition dose	Effective dose over 50 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/50 yrs]	[Sv/50 yrs]
667	1.53E-07	5.65E-10	7.26E-08	4.15E-07	2.01E-12	6.41E-07	2.59E-08	3.21E-05
1,333	4.25E-08	3.51E-10	5.84E-08	3.19E-07	1.18E-12	4.21E-07	1.58E-08	2.10E-05
2,333	2.56E-08	2.01E-10	4.44E-08	2.49E-07	7.43E-13	3.19E-07	9.24E-09	1.60E-05
3,333	1.48E-08	1.51E-10	3.25E-08	1.82E-07	5.68E-13	2.30E-07	6.97E-09	1.15E-05
4,333	9.92E-09	1.54E-10	2.54E-08	1.44E-07	5.96E-13	1.80E-07	7.10E-09	8.99E-06
5,333	7.19E-09	7.44E-11	2.11E-08	1.17E-07	2.69E-13	1.45E-07	3.41E-09	7.26E-06
6,333	5.50E-09	6.87E-11	1.82E-08	1.01E-07	2.54E-13	1.25E-07	3.16E-09	6.26E-06
7,333	4.38E-09	5.64E-11	1.62E-08	8.98E-08	2.09E-13	1.10E-07	2.60E-09	5.52E-06
8,667	3.36E-09	4.94E-11	1.42E-08	7.88E-08	1.85E-13	9.64E-08	2.27E-09	4.82E-06
10,667	2.42E-09	6.75E-11	1.20E-08	6.81E-08	2.61E-13	8.27E-08	3.12E-09	4.13E-06
12,667	1.83E-09	2.86E-11	1.05E-08	5.79E-08	1.04E-13	7.02E-08	1.32E-09	3.51E-06
14,667	1.44E-09	4.60E-11	9.27E-09	5.22E-08	1.72E-13	6.29E-08	2.12E-09	3.15E-06
17,333	1.10E-09	4.61E-11	8.02E-09	4.53E-08	1.65E-13	5.44E-08	2.11E-09	2.72E-06
21,667	8.18E-10	2.97E-11	8.50E-09	4.71E-08	9.55E-14	5.64E-08	1.35E-09	2.82E-06

Table D.I.112: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - children aged 2-7

Distance	Cloud dose	Deposition dose in 50th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 50th year of operation	Integral deposition dose	Effective dose over 50 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/50 yrs]	[Sv/50 yrs]
667	1.53E-07	5.65E-10	4.66E-08	2.56E-07	1.23E-12	4.56E-07	2.59E-08	2.28E-05
1,333	4.25E-08	3.51E-10	3.75E-08	1.97E-07	7.21E-13	2.77E-07	1.58E-08	1.39E-05
2,333	2.56E-08	2.01E-10	2.85E-08	1.54E-07	4.54E-13	2.08E-07	9.24E-09	1.04E-05
3,333	1.48E-08	1.51E-10	2.08E-08	1.12E-07	3.47E-13	1.48E-07	6.97E-09	7.41E-06
4,333	9.92E-09	1.54E-10	1.63E-08	8.89E-08	3.63E-13	1.15E-07	7.10E-09	5.76E-06
5,333	7.19E-09	7.44E-11	1.35E-08	7.23E-08	1.65E-13	9.30E-08	3.41E-09	4.65E-06
6,333	5.50E-09	6.87E-11	1.17E-08	6.26E-08	1.55E-13	7.99E-08	3.16E-09	3.99E-06
7,333	4.38E-09	5.64E-11	1.04E-08	5.55E-08	1.28E-13	7.03E-08	2.60E-09	3.51E-06
8,667	3.36E-09	4.94E-11	9.10E-09	4.87E-08	1.13E-13	6.12E-08	2.27E-09	3.06E-06
10,667	2.42E-09	6.75E-11	7.73E-09	4.20E-08	1.59E-13	5.22E-08	3.12E-09	2.61E-06
12,667	1.83E-09	2.86E-11	6.73E-09	3.58E-08	6.39E-14	4.44E-08	1.32E-09	2.22E-06
14,667	1.44E-09	4.60E-11	5.95E-09	3.22E-08	1.05E-13	3.96E-08	2.12E-09	1.98E-06
17,333	1.10E-09	4.61E-11	5.15E-09	2.79E-08	1.01E-13	3.42E-08	2.11E-09	1.71E-06
21,667	8.18E-10	2.97E-11	5.46E-09	2.91E-08	5.91E-14	3.54E-08	1.35E-09	1.77E-06

Table D.I.113: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - children aged 7-12

Distance	Cloud dose	Deposition dose in 50th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 50th year of operation	Integral deposition dose	Effective dose over 50 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/50 yrs]	[Sv/50 yrs]
667	1.53E-07	5.65E-10	3.05E-08	2.43E-07	6.92E-13	4.27E-07	2.59E-08	2.13E-05
1,333	4.25E-08	3.51E-10	2.44E-08	1.88E-07	4.01E-13	2.55E-07	1.58E-08	1.28E-05
2,333	2.56E-08	2.01E-10	1.86E-08	1.47E-07	2.53E-13	1.91E-07	9.24E-09	9.57E-06
3,333	1.48E-08	1.51E-10	1.36E-08	1.07E-07	1.93E-13	1.36E-07	6.97E-09	6.80E-06
4,333	9.92E-09	1.54E-10	1.07E-08	8.46E-08	2.01E-13	1.05E-07	7.10E-09	5.27E-06
5,333	7.19E-09	7.44E-11	8.83E-09	6.94E-08	9.22E-14	8.55E-08	3.41E-09	4.27E-06
6,333	5.50E-09	6.87E-11	7.64E-09	6.00E-08	8.67E-14	7.33E-08	3.16E-09	3.66E-06
7,333	4.38E-09	5.64E-11	6.78E-09	5.33E-08	7.12E-14	6.45E-08	2.60E-09	3.22E-06
8,667	3.36E-09	4.94E-11	5.94E-09	4.67E-08	6.27E-14	5.61E-08	2.27E-09	2.80E-06
10,667	2.42E-09	6.75E-11	5.05E-09	4.01E-08	8.80E-14	4.76E-08	3.12E-09	2.38E-06
12,667	1.83E-09	2.86E-11	4.40E-09	3.44E-08	3.57E-14	4.07E-08	1.32E-09	2.03E-06
14,667	1.44E-09	4.60E-11	3.89E-09	3.08E-08	5.85E-14	3.61E-08	2.12E-09	1.81E-06
17,333	1.10E-09	4.61E-11	3.36E-09	2.67E-08	5.66E-14	3.12E-08	2.11E-09	1.56E-06
21,667	8.18E-10	2.97E-11	3.57E-09	2.80E-08	3.38E-14	3.24E-08	1.35E-09	1.62E-06

Table D.I.114: Annual effective doses from external exposure and committed effective doses from annual intake in the 50th year of operation, calculated from operating values of discharges from 2 NPP Temelín units, approximately 1000 MW_e each (year 2050) - children aged 12-17

Distance	Cloud dose	Deposition dose in 50th year of operation	Committed inhalation dose	Committed ingestion dose	Committed inhalation dose from resuspension	Annual eff. dose in 50th year of operation	Integral deposition dose	Effective dose over 50 years of operation
[m]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/yr]	[Sv/50 yrs]	[Sv/50 yrs]
667	1.53E-07	5.65E-10	5.07E-08	1.85E-07	1.01E-12	3.89E-07	2.59E-08	1.95E-05
1,333	4.25E-08	3.51E-10	4.05E-08	1.43E-07	5.78E-13	2.27E-07	1.58E-08	1.13E-05
2,333	2.56E-08	2.01E-10	3.10E-08	1.12E-07	3.67E-13	1.69E-07	9.24E-09	8.46E-06
3,333	1.48E-08	1.51E-10	2.27E-08	8.21E-08	2.79E-13	1.20E-07	6.97E-09	5.99E-06
4,333	9.92E-09	1.54E-10	1.77E-08	6.45E-08	2.88E-13	9.23E-08	7.10E-09	4.62E-06
5,333	7.19E-09	7.44E-11	1.47E-08	5.30E-08	1.34E-13	7.50E-08	3.41E-09	3.75E-06
6,333	5.50E-09	6.87E-11	1.27E-08	4.59E-08	1.26E-13	6.42E-08	3.16E-09	3.21E-06
7,333	4.38E-09	5.64E-11	1.13E-08	4.07E-08	1.03E-13	5.64E-08	2.60E-09	2.82E-06
8,667	3.36E-09	4.94E-11	9.89E-09	3.57E-08	9.07E-14	4.90E-08	2.27E-09	2.45E-06
10,667	2.42E-09	6.75E-11	8.40E-09	3.05E-08	1.26E-13	4.14E-08	3.12E-09	2.07E-06
12,667	1.83E-09	2.86E-11	7.32E-09	2.63E-08	5.20E-14	3.55E-08	1.32E-09	1.78E-06
14,667	1.44E-09	4.60E-11	6.47E-09	2.35E-08	8.47E-14	3.14E-08	2.12E-09	1.57E-06
17,333	1.10E-09	4.61E-11	5.60E-09	2.03E-08	8.27E-14	2.71E-08	2.11E-09	1.35E-06
21,667	8.18E-10	2.97E-11	5.94E-09	2.14E-08	5.05E-14	2.82E-08	1.35E-09	1.41E-06

Power plant total after expansion

The following tables summarise calculated effective doses from gaseous discharges in normal operation per adult per year, for all directions. Among other things, they serve to assess cross-border impacts. The Czech Republic's borders with Austria and Germany are located 50 to 75 km from NPP Temelín (cross-border areas are highlighted in the table).

Table D.I.115: Effectives doses over 1 year [Sv], calculated from design values of discharges from 2 new and 2 existing units in 16 directions (sectors 1-8)

	Sector (compass point)							
Distance [m]	1 (N)	2 (NNE)	3 (NE)	4 (ENE)	5 (E)	6 (ESE)	7 (SE)	8 (SSE)
667	2.78E-06	5.61E-06	1.21E-05	1.07E-05	7.73E-06	4.48E-06	2.28E-06	2.15E-06
1,333	8.95E-07	1.80E-06	3.76E-06	3.36E-06	2.48E-06	1.53E-06	8.60E-07	7.89E-07
2,333	5.55E-07	1.12E-06	2.35E-06	2.12E-06	1.61E-06	1.00E-06	5.63E-07	5.09E-07
3,333	3.36E-07	6.79E-07	1.43E-06	1.29E-06	1.01E-06	6.41E-07	3.73E-07	3.33E-07
4,333	2.33E-07	4.70E-07	9.99E-07	9.00E-07	7.17E-07	4.60E-07	2.71E-07	2.43E-07
5,333	1.75E-07	3.52E-07	7.52E-07	6.78E-07	5.46E-07	3.49E-07	2.09E-07	1.89E-07
6,333	1.38E-07	2.79E-07	5.98E-07	5.41E-07	4.36E-07	2.78E-07	1.70E-07	1.52E-07
7,333	1.13E-07	2.29E-07	4.93E-07	4.45E-07	3.59E-07	2.31E-07	1.41E-07	1.29E-07
8,667	9.08E-08	1.84E-07	3.97E-07	3.57E-07	2.87E-07	1.84E-07	1.14E-07	1.31E-07
10,667	6.91E-08	1.41E-07	3.06E-07	2.75E-07	2.60E-07	1.65E-07	1.05E-07	1.07E-07
12,667	5.56E-08	1.13E-07	2.46E-07	2.21E-07	2.09E-07	1.54E-07	9.46E-08	6.41E-08
14,667	4.61E-08	9.38E-08	2.05E-07	1.84E-07	1.45E-07	1.08E-07	8.20E-08	5.31E-08
17,333	3.71E-08	7.59E-08	1.67E-07	1.49E-07	1.17E-07	7.38E-08	5.50E-08	4.31E-08
21,667	2.80E-08	6.09E-08	1.49E-07	1.16E-07	8.78E-08	5.51E-08	4.87E-08	4.41E-08
26,667	2.14E-08	4.53E-08	9.69E-08	8.61E-08	6.73E-08	4.22E-08	3.46E-08	3.20E-08
33,333	4.01E-08	8.49E-08	7.53E-08	1.62E-07	8.23E-08	3.19E-08	2.23E-08	3.08E-08
43,333	2.76E-08	5.82E-08	1.29E-07	1.11E-07	8.00E-08	4.49E-08	1.45E-08	2.37E-08
53,333	1.19E-08	4.35E-08	9.62E-08	8.27E-08	5.97E-08	3.37E-08	1.93E-08	1.79E-08
66,667	1.52E-08	2.38E-08	7.05E-08	6.08E-08	4.39E-08	2.48E-08	8.70E-09	1.33E-08
86,667	5.11E-09	1.37E-08	4.95E-08	4.27E-08	3.08E-08	1.74E-08	1.02E-08	9.47E-09

Table D.I.116: Effectives doses over 1 year [Sv], calculated from design values of discharges from 2 new and 2 existing units in 16 directions (sectors 9-16)

	Sector (compass point)							
Distance [m]	9 (S)	10 (SSW)	11 (SW)	12 (WSW)	13 (W)	14 (WNW)	15 (NW)	16 (NNW)
667	3.24E-06	5.66E-06	8.70E-06	6.14E-06	5.65E-06	4.03E-06	2.72E-06	2.53E-06
1,333	1.03E-06	1.80E-06	2.80E-06	2.02E-06	1.82E-06	1.37E-06	9.20E-07	8.08E-07
2,333	6.40E-07	1.13E-06	1.75E-06	1.27E-06	1.14E-06	8.87E-07	5.94E-07	5.06E-07
3,333	3.90E-07	6.91E-07	1.07E-06	7.71E-07	6.97E-07	5.65E-07	4.37E-07	3.08E-07
4,333	2.70E-07	4.80E-07	7.41E-07	5.33E-07	4.84E-07	4.64E-07	3.91E-07	2.13E-07
5,333	2.02E-07	3.60E-07	5.56E-07	3.99E-07	3.64E-07	4.73E-07	3.09E-07	1.61E-07
6,333	1.60E-07	2.85E-07	4.40E-07	3.15E-07	2.89E-07	3.53E-07	2.45E-07	1.27E-07
7,333	1.31E-07	2.34E-07	3.62E-07	2.59E-07	2.37E-07	2.82E-07	4.08E-07	1.05E-07
8,667	1.05E-07	1.87E-07	2.89E-07	2.07E-07	1.90E-07	1.72E-07	3.18E-07	8.34E-08
10,667	7.97E-08	1.43E-07	2.21E-07	1.58E-07	1.45E-07	1.24E-07	2.33E-07	6.35E-08
12,667	6.33E-08	1.14E-07	1.78E-07	1.26E-07	1.16E-07	9.93E-08	1.81E-07	5.08E-08
14,667	5.23E-08	9.44E-08	1.47E-07	1.05E-07	9.62E-08	8.20E-08	9.20E-08	4.19E-08
17,333	4.22E-08	7.62E-08	1.39E-07	2.33E-07	1.18E-07	6.62E-08	1.14E-07	3.37E-08
21,667	3.17E-08	1.43E-07	2.23E-07	1.67E-07	1.55E-07	4.94E-08	5.84E-08	2.53E-08
26,667	5.63E-08	1.05E-07	1.71E-07	1.23E-07	1.14E-07	3.80E-08	2.65E-08	1.94E-08
33,333	4.07E-08	7.51E-08	1.23E-07	8.86E-08	8.25E-08	4.77E-08	2.83E-08	1.54E-08
43,333	2.79E-08	5.11E-08	8.33E-08	6.08E-08	5.69E-08	3.03E-08	1.99E-08	2.39E-08
53,333	2.09E-08	3.80E-08	6.17E-08	4.53E-08	4.26E-08	3.25E-08	2.26E-08	1.79E-08
66,667	1.53E-08	2.77E-08	4.49E-08	3.33E-08	3.15E-08	2.40E-08	1.66E-08	1.32E-08
86,667	1.08E-08	1.93E-08	3.13E-08	2.34E-08	2.23E-08	1.69E-08	1.17E-08	9.23E-09

D.I.3.3.2. Impact of radioactive discharges into watercourses

Information on activity released from the plant is included in Chapter B.III.4.2. Radioactive discharges into watercourses. The volume of discharged active water is diluted in the total amount of all plant wastewater and then in the recipient (Vltava, Kořensko site). The average flow under consideration at the point of wastewater discharge to the Vltava is 50 m^3/s (see Chapter C.2.4.1. Open water, page 298 of this document) i.e. 1.57×10^9 m^3 per year.

Radiation impacts are calculated by the RDETE software, which is authorised by the State Office for Nuclear Safety. The software includes the migration of radioactive substances and their daughter products in the aquatic environment as well as estimates of the impact of swimming in the contaminated water, driving motorboats, residing on the sediment, residing on irrigated soil, ingestion of drinking water, ingestion of fish living in the contaminated water, ingestion of meat and milk of animals watered with the contaminated water and ingestion of agricultural produce contaminated by the irrigation (collectively "water use"). The exposure pathways under consideration are considered for all age groups.

PROJECT (UNITS 3+4)

2×1200 MW_e power alternative

Table D.I.117: Annual effective dose [Sv] from the use of water from the operation of 2 NNPP units of approximately 1200 MW_e

Age group [years]	Dose from water intake [Sv/yr]
0 to 1	1.05E-06
1 to 2	8.61E-07
2 to 7	9.63E-07
7 to 12	7.56E-07
12 to 17	6.35E-07
Adults	1.02E-06

2×1700 MW_e power alternative

Table D.I.118: Annual effective dose [Sv] from the use of water from the operation of 2 NNPP units of approximately 1700 MW_e

Age group [years]	Dose from water intake [Sv/yr]
0 to 1	1.82E-06
1 to 2	1.50E-06
2 to 7	1.67E-06
7 to 12	1.36E-06
12 to 17	1.18E-06
Adults	1.76E-06

PLANT (UNITS 1+2+3+4)

To obtain the values of total doses from discharges to watercourses from the power plant after expansion, the values of doses from the current NPP Temelín, specified in the tables below, must be added to the above values of doses from NNPP.

Existing plant 2×1000 MW_e

The existing plant has been in operation for more than 5 years at the date of preparation of this document. Thanks to that, the results of plant operation monitoring are available in addition to design data for discharges. Therefore, data for doses calculated from both design and measured values of discharges is included.

Data for doses calculated from design values of discharges is given in the following table:

Table D.I.119: Annual effective dose [Sv] from water use based on design values of discharges from 2 NPP Temelín units of approximately 1000 MW_e

Age group [years]	Dose from water intake [Sv/yr]
0 to 1	2.12E-07
1 to 2	1.67E-07
2 to 7	1.90E-07
7 to 12	1.48E-07
12 to 17	1.20E-07
Adults	1.68E-07

Data for doses calculated from operating (measured) values of discharges is given in the following table:

Table D.I.120: Annual effective dose [Sv] from water use based on operating values of discharges from 2 NPP Temelín units of approximately 1000 MW_e

Age group [years]	Dose from water intake [Sv/yr]
0 to 1	6.93E-06
1 to 2	5.48E-07
2 to 7	6.24E-07
7 to 12	4.88E-07

12 to 17	3.98E-07
Adults	5.75E-07

Power plant total after expansion

The following tables summarise calculated effective doses from liquid discharges in normal operation for 2 NNPP units + 2 NPP Temelín units:

Table D.I.121: Annual effective dose [Sv] from water use based on design values of discharges from 2 NPP Temelín units of approximately 1000 MW_e and 2 NNPP units of approximately 1200 MW_e

Age group [years]	Dose from water intake [Sv/yr]
0 to 1	1.26E-06
1 to 2	1.03E-06
2 to 7	1.15E-06
7 to 12	9.04E-07
12 to 17	7.55E-07
Adults	1.19E-06

Table D.I.122: Annual effective dose [Sv] from water use based on design values of discharges from 2 NPP Temelín units of approximately 1000 MW_e and 2 NNPP units of approximately 1700 MW_e

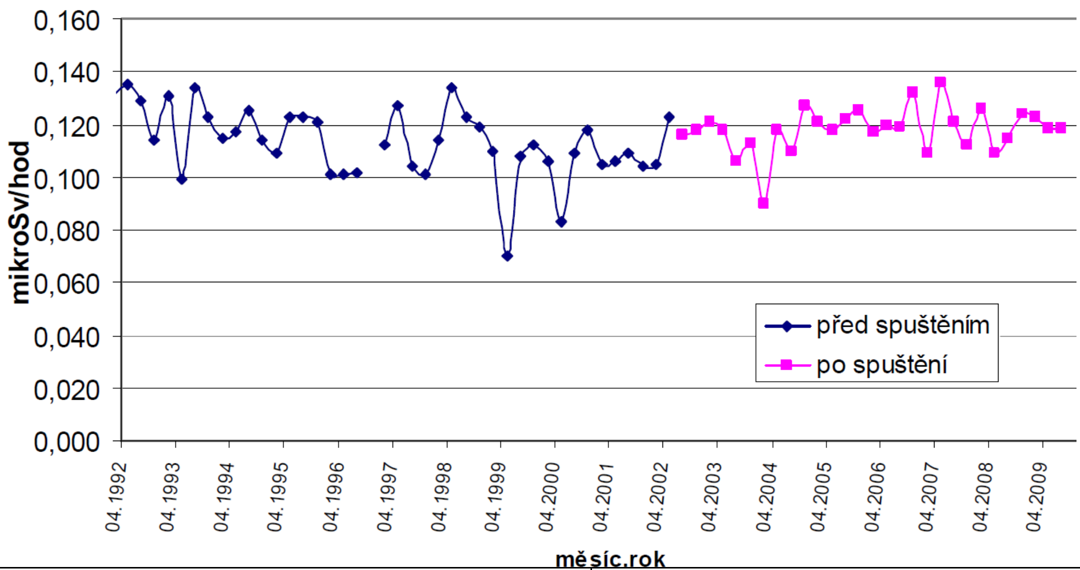
Age group [years]	Dose from water intake [Sv/yr]
0 to 1	2.03E-06
1 to 2	1.67E-06
2 to 7	1.86E-06
7 to 12	1.51E-06
12 to 17	1.30E-06
Adults	1.93E-06

D.I.3.3.3. Impact of radiation field

PROJECT (UNITS 3+4)

The impact of the radiation field (direct exposure from the plant without the impacts of discharges) is insignificant. This assumption is based on the monitoring of the existing power plant's operation, which does not show any differences between radiation situations at the site before and after commissioning. This is documented by the following Figure.

Figure D.I.2: Development of dose equivalent rate from January 1991 to September 2009 at the NPP Temelín site (environmental radiation monitoring station at gas boiler house)



mikroSv/hod	microSv/h

měsíc.rok	month.year
Před spuštěním	Before being put into operation
Po spuštění	After being put into operation

Statistical analysis of the data proves that the commissioning and operation of NPP Temelín did not have any impact on the value of the dose equivalent rate at the NPP Temelín site in the period in question.

PLANT (UNITS 1+2+3+4)

The same applies to the power plant after expansion.

D.I.3.4. Impacts of non-ionising radiation

PROJECT (UNITS 3+4)

The power generation plant (generators, transformers) is enclosed within the site and does not affect publicly accessible areas by its electric and magnetic field. The project includes lines for power output to the Kočín switchyard (two new 400 kV lines, Delta-type pylons) and power supply for the power plant from the Kočín switchyard (two new double 110 kV lines, Janda pylons). They run through publicly accessible space between the power plant and the switchyard; however, there are no permanent residential buildings located in the area.

The maximum permissible value of induced current density in a human body (for other persons, i.e. the public) is defined in Government Decree Nn. 1/2008 Coll., on the protection of health from non-ionising radiation, as J = 2 mA/m^2. It also specifies reference values for electric and magnetic fields, E = 5 kV/m and B = 100 μT, respectively. These reference values may be exceeded if the above-mentioned permissible value of induced current density of J = 2 mA/m^2 is not exceeded.

A minimum height of above ground wires is specified to prevent exceeding the permissible value of induced current density in a human body in the corridor of the existing and new 400 kV and 110 kV lines from NPP Temelín to the Kočín switchyard. The minimum height of wires is specified as 12.8 m or 12.1 m for the new 400 kV line (depending on the arrangement of its phase sequence) and 6 m for the new 110 kV line (satisfactory regardless of its phase sequence).

On this assumption, the requirements of Government Decree no. 1/2008 Coll., on the protection of health from non-ionising radiation, will be well satisfied. Therefore, an adverse impact of non-ionising radiation on the population can be excluded.

PLANT (UNITS 1+2+3+4)

The above assessment also applies to the power plant as a whole. Thanks to the spacing of individual lines (the protection zone of a 400 kV line is 20 m from the outside wire), their impacts do not cumulate.

D.I.3.5. Impacts during the preparation and implementation period

D.I.3.5.1. Noise impacts

D.I.3.5.1.1. Noise from the construction site

Noise resulting from individual activities and installations at the construction site is summarised in the following table.

Table D.I.123: Results of equivalent noise level calculations for construction site noise

	Equivalent noise level LrD (day) [dB(A)]							
	MB01	MB02	MB03	MB04	MB05	MB06	MB07	MB08
Limit	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
Topsoil removal, site accommodation	35.8	40.8	49.8	49.6	44.5	39.4	37.1	45.9
Topsoil removal, main site	29.5	31.9	37.8	37.6	37.1	33.8	37.9	49.7
Excavations at MS (up to 1000 MW)	31.3	35.7	42.3	42.1	38.4	33.1	35.0	49.1

Excavations at MS (above 1000 MW)	32.1	36.0	42.8	42.6	39.2	34.1	35.9	49.4
Construction of main generating unit and other structures	29.1	31.6	37.7	37.4	35.8	32.6	35.5	47.2
Equipment installation	23.8	26.4	33.5	32.0	30.7	27.0	27.9	36.8

Note: For point locations refer to Chapter C.2.3. Noise and other physical and biological characteristics (page 257 of this document).

It is clear that hygienic limits for noise from construction work are complied with, with a huge margin, at all monitored checkpoints representing the nearest or most affected protected outside area / protected outside area of a building. Therefore, no additional measures are proposed.

D.I.3.5.1.2. Noise from construction traffic

Calculation areas are selected for all municipalities through which the monitored roads used by construction traffic run. The calculation areas are restricted to the immediate surroundings of roads running through the municipalities. Data for traffic intensities in connection with construction activities is provided in Chapter B.II.4. Demands on transport and other infrastructures (page 192 of this document). Determined equivalent noise levels at calculation points are shown in the following table.

Table D.I.124: Levels of noise from construction traffic

Site	Checkpoint	Floor	Future situation, without construction traffic, year 2015		Future situation, with construction traffic, year 2015		Difference	
			Day	Night	Day	Night	Day	Night
Albrechtice nad Vltavou	ALBR 1	1	59.5	52.2	61.6	53.5	2.1	1.3
		2	59.4	52.1	61.5	53.4	2.1	1.3
	ALBR 2	1	64.4	57.5	64.4	57.6	0.0	0.0
		2	64.3	57.5	64.3	57.5	0.0	0.0
	ALBR 3	1	67.2	59.8	67.9	60.6	0.7	0.8
		2	66.9	59.5	67.6	60.3	0.7	0.8
	ALBR 4	1	66.4	58.9	67.3	59.9	0.8	1.0
		2	66.1	58.6	66.9	59.5	0.8	1.0
	ALBR 5	1	67.0	59.5	67.9	60.5	0.9	1.0
		2	66.4	58.9	67.3	59.9	0.8	1.0
Bečice	BEC 1	1	66.5	59.2	67.2	59.7	0.7	0.5
		2	66.2	59.0	66.9	59.5	0.7	0.5
Bechyňská Smoleč	BECH 1	1	64.8	57.7	65.3	57.7	0.5	0.0
		2	64.6	57.5	65.1	57.5	0.5	0.0
Březnice	BREZ 1	1	65.8	58.7	66.5	59.0	0.8	0.3
		2	66.6	59.5	67.3	59.8	0.8	0.3
	BREZ 2	1	68.9	61.8	69.6	62.1	0.7	0.3
		2	68.7	61.6	69.4	61.9	0.8	0.3
	BREZ 3	1	68.3	61.2	69.2	61.2	0.9	0.0
		2	67.1	60.1	68.1	60.1	0.9	0.0
Bzí	BZI 1	1	71.7	64.5	72.4	65.0	0.7	0.5
		2	70.1	62.9	70.9	63.4	0.7	0.5
Chvalešovice	CHVAL 1	1	67.8	60.4	67.8	60.7	0.0	0.3
		2	67.3	60.0	67.4	60.3	0.0	0.3
Číčenice	CICE 1	1	65.8	58.5	65.9	58.8	0.0	0.3
		2	65.6	58.2	65.6	58.5	0.0	0.3
Dolní Bukovsko	DBUK 1	1	68.1	60.9	68.8	61.4	0.7	0.4
		2	67.8	60.6	68.5	61.0	0.7	0.4
Dívčice	DIVC 1	1	68.4	61.3	68.5	61.3	0.1	0.0
		2	68.0	61.0	68.1	61.0	0.1	0.0
Dříteň	DRIT 1	1	65.9	58.9	66.0	58.9	0.1	0.0
		2	65.7	58.6	65.8	58.6	0.1	0.0
	DRIT 2	1	66.7	59.4	66.5	59.4	0.1	0.0
		2	66.2	59.1	66.3	59.1	0.1	0.0
Hluboká nad Vltavou	HLUB 1	1	69.5	62.3	69.7	62.5	0.2	0.2
		2	69.6	62.3	69.7	62.6	0.2	0.2
	HLUB 2	1	65.5	58.3	65.5	58.3	0.0	0.0
		2	65.5	58.3	65.6	58.4	0.1	0.1
Lomnice nad Lužnicí	LOM 1	1	69.6	62.3	69.9	62.7	0.2	0.4
		2	69.2	61.8	69.4	62.2	0.2	0.4
Malšice	MAL 1	1	67.8	60.8	68.3	60.8	0.5	0.0

		2	67.5	60.4	68.0	60.4	0.5	0.0
Nákří	NAKRI 1	1	70.9	63.9	71.0	63.9	0.1	0.0
		2	69.6	62.6	69.7	62.6	0.1	0.0
Neplachov	NEPL 1	1	65.3	58.3	65.8	58.3	0.5	0.0
		2	64.7	57.6	65.2	57.6	0.5	0.0
Novosedly	NOVOS 1	1	64.6	56.8	64.6	56.8	0.0	0.0
		2	63.8	56.0	63.8	56.0	0.0	0.0
Nová Ves	NVES 1	1	60.8	53.4	61.5	53.8	0.7	0.4
		2	60.8	53.4	61.5	53.9	0.8	0.5
Paseky	PASE 1	1	66.7	59.2	67.5	60.2	0.8	1.0
		2	65.5	58.1	66.4	59.0	0.8	1.0
Podeřiště	POD 1	1	62.0	53.9	62.3	55.6	0.3	1.7
		2	61.6	53.5	61.9	55.1	0.3	1.7
Sedlec	SEDL 1	1	63.7	56.3	63.7	56.6	0.0	0.3
		2	63.5	56.2	63.6	56.5	0.0	0.3
Sudoměřice u Bechyně	SUD 1	1	68.4	61.3	68.9	61.3	0.5	0.0
		2	67.8	60.7	68.2	60.7	0.5	0.0
Tálín	TAL 1	1	65.9	58.4	66.7	59.3	0.8	1.0
		2	65.3	57.8	66.1	58.8	0.8	1.0
Temelín	TEM 1	1	59.4	51.8	59.4	51.8	0.0	0.0
		2	59.0	51.4	59.0	51.4	0.0	0.0
	TEM 2	1	61.9	54.8	62.9	55.4	0.9	0.7
		2	61.9	54.7	62.8	55.4	1.0	0.7
	TEM 3	1	62.9	56.9	64.8	57.9	1.9	1.0
		2	62.8	56.8	64.7	57.7	1.9	1.0
	TEM 4	1	63.3	57.3	65.3	58.4	2.0	1.1
		2	63.1	57.1	65.0	58.0	1.9	0.9
	TEM 5	1	64.0	57.5	65.2	58.1	1.3	0.6
		2	64.3	57.8	65.6	58.5	1.3	0.7
	TEM 6	1	56.9	49.8	58.8	50.4	1.9	0.6
		2	57.0	50.0	58.9	50.6	1.9	0.6
	TEM 7	1	59.9	52.8	61.9	53.5	2.0	0.7
		2	59.8	52.7	61.8	53.4	2.0	0.6
Týn nad Vltavou	TYN 1	1	64.2	56.9	65.1	57.6	0.9	0.6
		2	64.4	57.1	65.5	58.0	1.1	0.9
	TYN 2	1	58.4	51.2	59.5	52.0	1.0	0.8
		2	58.5	51.2	59.6	52.1	1.1	0.9
		3	58.6	51.4	59.7	52.2	1.1	0.8
		4	58.7	51.4	59.8	52.3	1.1	0.8
		5	58.9	51.6	59.9	52.4	1.1	0.8
		6	59.0	51.8	60.1	52.6	1.1	0.8
	TYN 3	1	61.2	53.9	62.2	54.7	1.0	0.8
		2	61.2	53.9	62.3	54.8	1.1	0.9
		3	61.2	53.9	62.3	54.8	1.1	0.9
		4	61.2	53.9	62.3	54.8	1.1	0.9
		5	61.1	53.8	62.2	54.7	1.1	0.9
		6	61.1	53.8	62.2	54.7	1.1	0.9
	TYN 4	1	63.2	55.9	64.2	56.5	1.0	0.5
		2	63.3	56.0	64.3	56.6	1.0	0.6
	TYN 5	1	60.6	53.5	61.2	53.7	0.6	0.1
		2	60.6	53.5	61.3	53.7	0.7	0.3
	TYN 6	1	60.3	53.2	61.0	53.5	0.8	0.3
		2	61.8	54.8	62.6	55.1	0.8	0.3
Všechlapy	VSECH 1	1	66.2	59.1	66.6	59.1	0.5	0.0
		2	66.2	59.1	66.6	59.1	0.5	0.0
Všemyslice	VSEM 1	1	59.6	51.7	60.7	51.7	1.1	0.0
		2	59.1	51.2	60.2	51.2	1.1	0.0
Všeteč	VSET 1	1	58.0	50.9	59.6	51.3	1.6	0.3
		2	58.2	51.1	60.1	51.7	1.9	0.6
	VSET 2	1	58.8	51.8	60.8	52.5	2.0	0.7
		2	59.5	52.4	61.5	53.1	2.0	0.7
	VSET 3	1	56.4	49.1	58.4	50.3	2.1	1.3
		2	56.4	49.1	58.5	50.4	2.1	1.3
Žimutice	ZIM 1	1	68.5	61.3	69.3	61.8	0.7	0.5
		2	68.1	60.9	68.9	61.4	0.7	0.5
Zvěrkovice	ZVER 1	1	61.8	54.4	62.0	54.7	0.2	0.3
		2	61.9	54.6	62.1	54.8	0.1	0.2
	ZVER 2	1	65.7	58.4	66.7	59.4	0.9	1.0
		2	65.7	58.4	66.7	59.4	0.9	1.0

It is obvious that for virtually all municipalities in question, noise limits in the vicinity of main roads ($L_{Aeq,T}$ = 60/50 dB day/night) are found to be exceeded in the future, regardless of the impact of any traffic related to construction under the project (shown in red in the table).

The increase in noise levels at the points of calculation due to construction traffic related to project construction ranges from 0.1 to 2.2 dB in the daytime and from 0.1 to 1.7 dB in the night time. An increase of 0.6 dB is considered unverifiable, immeasurable and subjectively unnoticeable and thus insignificant for further assessment. For remaining points (shown in blue in the table), it will be necessary to take measures to reduce noise, either organisational (time, routes and manners of transport) or technical (noise abatement measures – barriers, building windows or other).

D.I.3.5.2. Vibration impacts

The impacts of vibration during the construction and erection period will not spread beyond the closest vicinity of their place of origination (vibrational compaction, pneumatic drills, etc.); they will never affect a wider neighbourhood or residential areas.

The use of explosives during the construction is not anticipated.

D.I.3.5.3. Impacts of ionising radiation

No radionuclides will be released into the air or watercourses, no field of ionising radiation will be produced and no radioactive waste will be generated during project preparation and implementation (construction and erection work).

Construction will be carried out simultaneously with the operation of the two existing units of the power plant, its radiation impacts will not change in any way as a result of the project.

D.I.3.5.4. Impacts of non-ionising radiation

There will be no impacts of non-ionising radiation during project preparation and implementation; power output lines and backup supply lines for the new power plant will not be in operation.

D.I.3.6. Impacts in the shutdown period

D.I.3.5.1. Noise impacts

Noise impacts will be insignificant in the shutdown period. If demolition or dismantling work is carried out, the above-mentioned impacts will not exceed those in the construction period.

D.I.3.5.2. Vibration impacts

Vibration impacts are out of question for the shutdown period.

D.I.3.5.3. Impacts of ionising radiation

Radiation impacts will further decrease significantly, by several orders of magnitude, in the shutdown stage and other decommissioning stages. Radioactive discharges in the shutdown period will be reduced in comparison with the operating period as follows:

Shutdown stage:

Discharges to the air:

Noble gases and aerosols:	decrease by approximately 3 orders of magnitude, to approximately 10^{12} to 10^{13} Bq/year
Tritium:	decrease approximately 10x, to approximately 10^{12} Bq/year
Iodines:	decrease by approximately 4 orders of magnitude, to approximately 10^{6} Bq/year
^{14}C:	decrease approximately 10x, to approximately 10^{11} Bq/year

Discharges into watercourses:

Total activity (without tritium):	decrease by approximately 3 to 4 orders of magnitude, to approximately 10^6 to 10^7 Bq/year
Tritium:	decrease approximately 10x, to approximately 10^{13} Bq/year

Other decommissioning stages:

Discharges to the air:

Noble gases and aerosols:	decrease by approximately 2 orders of magnitude, to approximately 10^{10} to 10^{11} Bq/year
Tritium:	decrease by approximately 2 orders of magnitude, to approximately 10^{10} Bq/year
Iodines:	decrease by approximately 1 to 2 orders of magnitude, to approximately 10^4 to 10^5 Bq/year
^{14}C:	decrease by approximately 1 to 2 orders of magnitude, to approximately 10^9 to 10^{10} Bq/year

Discharges into watercourses:

Total activity (without tritium):	decrease by approximately 1 to 2 orders of magnitude, to approximately 10^4 to 10^6 Bq/year
Tritium:	decrease approximately 10x, to approximately 10^{12} Bq/year

Corresponding effective doses will decrease accordingly.

D.I.3.5.4. Impacts of non-ionising radiation

The above-mentioned impacts of non-ionising radiation will cease in the shutdown period.

D.I.4. Impacts on surface water and groundwater

D.I.4.1. Impacts on surface water

D.I.4.1.1. Impact on the area drainage pattern

PROJECT (UNITS 3+4)

During the construction of the NNPP, some previously open areas will be paved and drained to a new storm sewer system, connected to the existing sewerage. All such collected water will be drained to the Strouha brook and then to the Vltava (backwater of the Hněvkovice reservoir). This amount is insignificant in terms of its effect on the flow rate of the Vltava at that point.

Transferring some rainwater and groundwater from the power plant site to basin 1-06-03-073 (Strouha - unaffected average runoff of 0.043 m^3/s) means increasing the average runoff from this basin by tens of percent. Peak runoffs during rainstorms will be collected by a retention reservoir.

The collection and drainage of rainwater may theoretically result in a decrease in flow characteristics in the upper parts of small basins. This concerns especially no. 1-08-03-079/2 (Temelínecký Brook).

The construction of power output to the Kočín switchyard will not affect the drainage pattern of the area.

PLANT (UNITS 1+2+3+4)

Generally, there is an increase in the impact on the area drainage pattern that had previously been caused by completing the construction and drainage of the existing Temelín NPP site. Changes will be manifested mainly by increased flow rates due to more rainwater discharged into the Strouha stream. In addition to existing basins 1-08-03-079/3 (Malešický Brook) and 1-06-03-077 (Palečkův Brook), rainwater reduction in the upper part will also affect basin 1-08-03-079/2 (Temelínecký Brook) after the construction of the NNPP. The impact is generally insignificant.

D.I.4.1.2. Impact on hydrological characteristics

PROJECT (UNITS 3+4)

The evaluation relates to the power alternatives of 2x1200 MW_e (with one or two Iterson cooling towers per reactor unit) and 2x1700 MW_e (two Iterson cooling towers per reactor unit) with their potential maximum effect.

The increased withdrawal of process water from the Vltava at Hněvkovice will result in a decreased annual average runoff downstream of the Hněvkovice reservoir. However, some of the withdrawn water will be returned to the Vltava at Kořensko. The most prominent effect on the Vltava's hydrological characteristics can thus be seen in its section downstream of the Hněvkovice reservoir. Downstream of the Kořensko reservoir, where inflow from the Lužnice and discharge of wastewater from the power plant come into play, the decrease in average flow is less significant. The effect on flow rates downstream of the Hněvkovice and Kořensko reservoirs will not be significant except for low-flow (low-water) periods. During such period, water withdrawal for the operation of the power plant may decrease flow rates by up to tens of percent; however, the low flow rates in the Vltava will always be improved by reservoirs upstream of the Hněvkovice reservoir to eliminate the impact of power plant operation in comparison with the unaffected situation. Cooperation between the Lipno and Hněvkovice reservoirs will ensure the required minimum flow rate downstream of the Hněvkovice reservoir (today 6.5 m^3/s) as well as in the Vltava downstream of its confluence with the Lužnice (today 9.5 m^3/s).

The effects of NPP Temelín operation, including the NNPP, on hydrological characteristics in the entire Vltava basin are analysed in more detail in the "Study of the feasibility of water withdrawal from the Hněvkovice reservoir for the future extension of NPP Temelín"; see Annexes hereto.

The collection of rainwater at the site of the NNPP and its discharge through a sewer will result in faster rainwater discharge from the area to surface waters at the expense of infiltration. This may result in decreased spring discharges and thus in a change in the hydrological characteristics of watercourses in the upper parts of small basins (decreased flow rates). If the NNPP is built, this will especially concern a part of the spring area and small streams in the upper part of basin 1-08-03-079/2 (Temelínecký Brook). At the same time, the removal of rainwater to the receiving body will increase flow rates in the receiving body - the Strouha Brook. The changes are relatively significant in the upper parts of streams (changes of up to tens of percent can be expected); the effect is less and less prominent towards the mouth.

The construction of power output to Kočín does not affect hydrological characteristics.

PLANT (UNITS 1+2+3+4)

The effects of NPP Temelín operation, including the NNPP, on hydrological characteristics in the entire Vltava basin are analysed in more detail in the "Study of the feasibility of water withdrawal from the Hněvkovice reservoir for the future extension of NPP Temelín"; see Annexes hereto. The study discusses the feasibility of water withdrawal from the Vltava at the Hněvkovice reservoir for the future extension of NPP Temelín and the impacts on the Vltava River as far as its mouth, including impacts on power generation in the Vltava cascade of hydroelectric dams. The analysis was prepared for variants with withdrawal by NPP Temelín and by NPP Temelín and the NNPP over a range of power alternatives from the current 2000 MW_e to 5400 MW_e. Demand for other withdrawals and discharges of water in the basin of interest are within the limits permitted by water authorities. The analysis was prepared both for the existing hydrological conditions and for hydrological conditions affected by climate changes in the time horizon of 2025. The climate change scenario under consideration is based on the Aladin control model of climate system circulation and emission scenario A1B.

The study shows that NPP Temelín's demand for water withdrawals are satisfied sufficiently for all NPP power variants under consideration, both under the current hydrological conditions and under hydrological conditions affected by the climate change in the reference year 2025. The requirements for the minimum flow rates downstream of the Lipno I, Lipno II, Hněvkovice and Kořensko reservoirs will also be satisfied. Considering the use of the entire storage volume of the Lipno I and Hněvkovice reservoirs for water accumulation, the satisfaction of the requirements was evaluated as trouble-free. The impact on the water level regime for ensuring a recreational water level in the Lipno I reservoir in summer (June to August) at a level of 723.6 m above sea level is not significant either: the dependability of the water level under the current conditions is evaluated as "trouble-free"; under hydrological conditions affected by the climate change, it exceeds the dependability to duration for recreational purposes recommended by the standard, p_t rec. 95%, in all variants under consideration (for the least favourable variant, p_t has a value of 96.6%). The assessment of the impact of other withdrawals and discharges (other than withdrawals for the Temelín NPP) according to limits permitted in water use authorisations instead of estimated future values and actual values (reported values of actual withdrawals and discharges) has no relevant impact on the dependability of the above-mentioned requirements.

The impact of water withdrawals (or consumption, as the difference between withdrawal and discharge back to the watercourse) for NPP Temelín on the Vltava from the dam of the Hněvkovice reservoir to the mouth (Kořensko underground facility) was assessed in terms of fulfilment of requirements for the dependability of required minimum flow rates under the Vrané reservoir and at check (balance) points in Zbraslav, Prague - Chuchle and Vraňany and the impact on the hydrological regime at Vraňany.

The critical point is Vrané, where a minimum discharge of 40 m^3/s from the reservoir is required (as opposed to e.g. the required minimum residual flow rate of 24.350 m^3/s at Vraňany). While under current hydrological conditions the minimum flow rates are dependable enough at all of the above points, the analysis for the conditions of the climate change indicates possible problems with ensuring the minimum flow rates at Vrané, Zbraslav and Prague - Chuchle, where the minimum flow rates do not achieve the dependability recommended by the standard, $p_t = 98.5\%$, for any NPP withdrawal/consumption variant (with the least favourable variant, they have a value of 96.6%). Nevertheless, the results show that the primary cause is the possible impact of the climate change on flow rates at the basin in question rather than increased withdrawal/consumption demands at the Temelín NPP.

Under the current hydrological conditions, minimum flow rate requirements are met for all withdrawal variants at all points in question; on the contrary, under the conditions of climate change, minimum flow rate requirements are not met under any variant, with the difference in dependability to duration pt between the extreme variants of 2000 MWe and 5200 MW_e being 0.6%, which for a 26-year series of hydrological data means 2 "trouble" months.

Analogous conclusions can be drawn from the results of the assessment of impacts on electricity generation at the Vltava cascade hydroelectric power stations, where it is possible to see considerable differences in potential power generation between the existing hydrological conditions and the hydrological conditions of the climate change and, on the contrary, minimum differences between the various alternatives of water withdrawal/consumption at NPP Temelín.

The collection of rainwater at the site of the Temelín NPP and the NNPP and its discharge through a sewer will result in faster rainwater discharge from the small basins no. 1-08-03-079/3 (Malešický Brook), no. 1-06-03-077 (Palečkův Brook), newly after the construction of the NNPP also no. 1-08-03-079/2 (Temelínecký Brook) to the basin of the receiving course – Strouha, no. 1-06-03-073. This may result in decreased spring discharges and thus in a change in the hydrological characteristics of watercourses in the upper parts of small basins (decreased flow rates). The changes are relatively significant in the upper parts of streams (changes of up to tens of percent can be expected); the effect is less and less prominent towards the mouth.

At the same time, the removal of rainwater to the receiving body will change the hydrological characteristics of Strouha Brook (increase in flow rates).

D.I.4.1.3. Impact on surface water quality

PROJECT (UNITS 3+4)

The assessment of the impacts of the individual power alternatives on surface water quality is carried out and its results are commented primarily in aggregate for the power plant as a whole (see below).

Calculated values of the average concentrations and increments in the concentration of quality indicators i in the Vltava at Kořensko after mixing up with wastewater from the NNPP (aggregated with those of the

Temelín NPP), the average annual concentrations of quality indicators i in the Vltava upstream of the wastewater discharge and applicable water pollution limits/corresponding annual averages according to Government Decree no. 61/2003 Coll., as amended, or the Guidelines, for the individual NNPP power alternatives and for the parallel operation of the NNPP and the Temelín NPP and for years 2020, 2025, 2050, 2085 and for all climate development scenarios are included in Annexes thereto.

PLANT (UNITS 1+2+3+4)

Changes in quality indicators, or the existing impact of NPP Temelín and the future impact of the TNPP and NNPP on receiving water, depend mainly on the content of substances withdrawn with process water and, to a lesser degree, on substances introduced into wastewater from processes in the TNPP and, in the future, TNPP + NNPP.

Effect of Temelín NPP

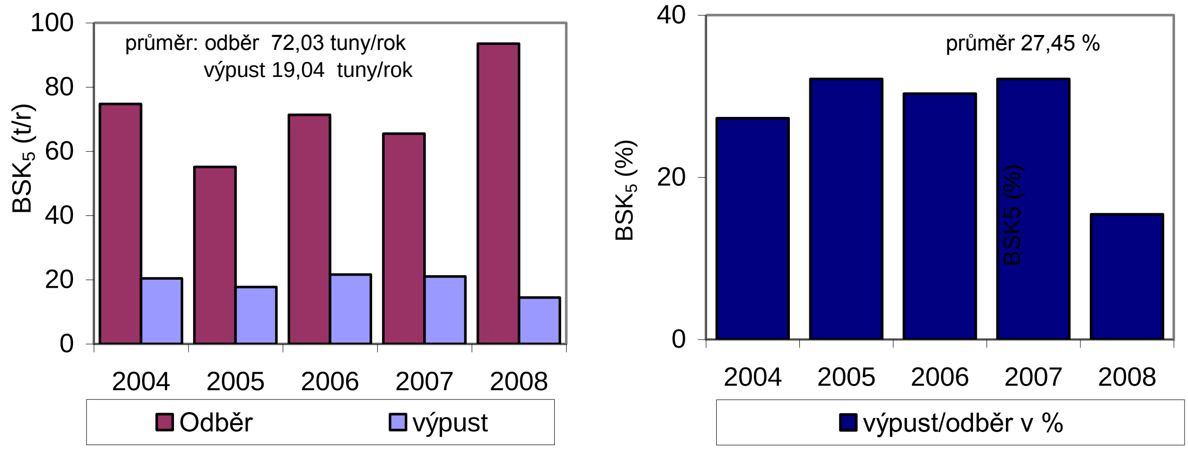
Below we show a comparison between individual monitored indicators in withdrawn and discharged water during the existing operation of NPP Temelín. The comparison was based on a calculation using known amounts and pollution of raw water withdrawn in each year of TNPP operation and known amounts of discharged water and its pollution. The assessment also used average values; included below is e.g. a table with the amounts of wastewater discharged from the TNPP in 2004-2008.

Table D.I.125: Annual quantities of wastewater discharged by NPP Temelín, 2004-2008, average values and annual wastewater limit set by the South Bohemia Regional Authority Statement

	2004		2005		2006		2007		2008		Average 2004-2008	
	[$m^3.yr^{-1}$]	[%]	[$m^3.yr^{-1}$]	[%]	[$m^3.yr^{-1}$]	[%]	[$m^3.yr^{-1}$]	[%]	[$m^3.yr^{-1}$]	[%]	[$m^3.yr^{-1}$]	[%]
Permitted discharge	9,342,000.00		9,342,000.00		9,342,000.00		9,342,000.00		9,342,000.00		9,342,000.00	
Actual discharge	8,169,123.00	87.45	7,615,153.00	81.52	7,882,780.00	84.38	7,815,844.00	83.66	6,042,423.00	64.68	7,505,064.60	80.34
Blowdown	7,902,809.59	96.74	7,341,007.49	96.40	7,605,306.14	96.48	7,658,745.54	97.99	5,833,355.16	96.54	7,268,244.79	96.83
WWTP	160,931.72	1.97	200,278.52	2.63	213,623.34	2.71	102,387.56	1.31	137,767.24	2.28	162,997.68	2.18
Neutralisation	80,874.32	0.99	43,406.37	0.57	37,837.34	0.48	36,734.47	0.47	41,088.48	0.68	47,988.20	0.64
Control tanks (CTs)	25,324.28	0.31	30,460.61	0.40	26,013.17	0.33	17,976.44	0.23	30212.12	0.50	25,997.32	0.35
WWTP+neutral.+CTs	267,130.32	3.27	274,145.51	3.60	277473.86	3.52	157,098.46	2.01	209,067.84	3.46	236,983.20	3.17

Results comparing the balance of substances in discharged wastewater in $t.yr^{-1}$ and in relative units in % for 2004 to 2008 were put into charts for the period (see the figures below).

Figure D.I.3: Comparison of balances of BOD_5 withdrawn with process water and in wastewater discharged from TNPP, 2004-2008

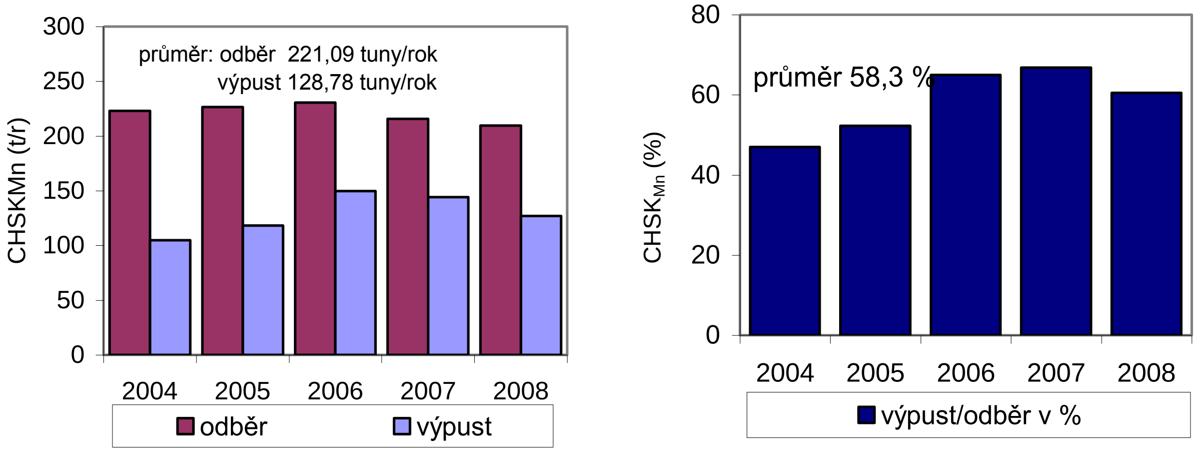


průměr: odběr 72,03 tuny/rok výpust 19,04 tuny/rok	average: consumption 72.03 tons per year discharge 19.04 tons per year
Odběr	consumption
Výpust	discharge

BSK5 (t/r)	BOD5 (t/year)
průměr 27,45%	average 27.45%
výpust/odběr v %	discharge/consumption in %

For the five-day biochemical oxygen demand (BOD_5) indicator, the average value of annual balance was 72.0 $t.yr^{-1}$ in withdrawn water and 19.0 $t.yr^{-1}$ in discharged wastewater. It is typical of the BOD_5 indicator that the power plant releases much less BOD_5 than it takes in with process water. The average ratio of BOD_5 balance in water discharged from the Temelín NPP was 27.5% in relation to the balance in withdrawn process water. The ratio of BOD_5 in wastewater from the NPP Temelín wastewater treatment plant to the flow of all wastewater was 2.7% on average in 2004-2007.

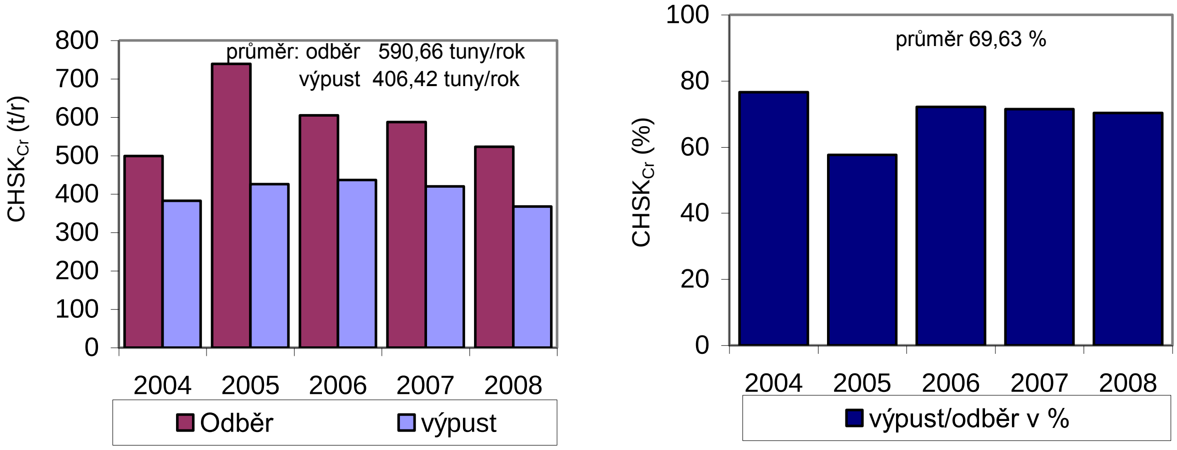
Figure D.I.4: Comparison of balances of COD_{Mn} withdrawn with process water and in wastewater discharged from TNPP, 2004-2008



průměr: odběr 221,09 tuny/rok výpust 128,78 tuny/rok	average: consumption 221.09 tons per year discharge 128.78 tons per year
Odběr	Consumption
Výpust	Discharge
CHSKMn (t/r)	CODMn (t/year)
průměr 58,3%	average 58.3%
výpust/odběr v %	discharge/consumption in %

As for the indicator of chemical oxygen demand measured with permanganate (COD_{Mn}), the power plant also released less than it took in with process water. The average ratio of COD_{Mn} balance in water discharged from NPP Temelín was 58.3% in relation to the balance in withdrawn process water.

Figure D.I.5: Comparison of balances of COD_{Cr} withdrawn with process water and in wastewater discharged from TNPP, 2004-2008

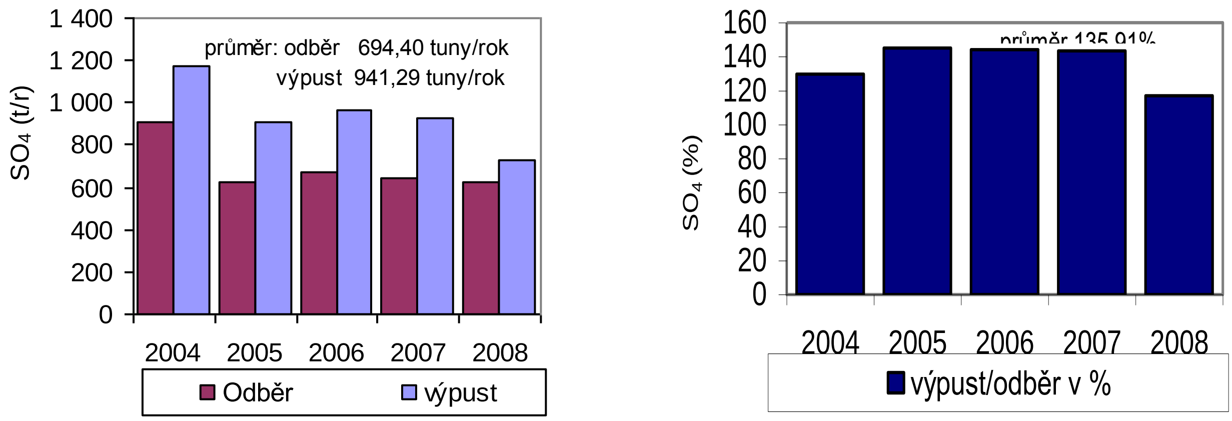


průměr: odběr 590,66 tuny/rok výpust 406,42 tuny/rok	average: consumption 590.66 tons per year discharge 406.42 tons per year
Odběr	Consumption
Výpust	Discharge
CHSKCr (t/r)	CODCr (t/year)
průměr 69,63%	average 69.63%
výpust/odběr v %	discharge/consumption in %

As for the indicator of chemical oxygen demand measured with dichromate (COD_{Cr}), a decrease in the balance in discharged water similar to that of COD_{Mn} was seen, namely 69.6% on average. The ratio of COD_{Cr} in wastewater from the Temelín NPP wastewater treatment plant to the flow of all wastewater was 0.94%.

The above indicators clearly show that there is a significant decrease in their concentration and thus their balance, especially in the cooling circuit. If the contribution of the same substances running off with wastewater from the WWTP were deducted, the impact of "self-purification" in the NPP water economy would be even greater.

Figure D.I.6: Comparison of balances of sulphates (SO_4) withdrawn with process water and in wastewater discharged from TNPP, 2004-2008

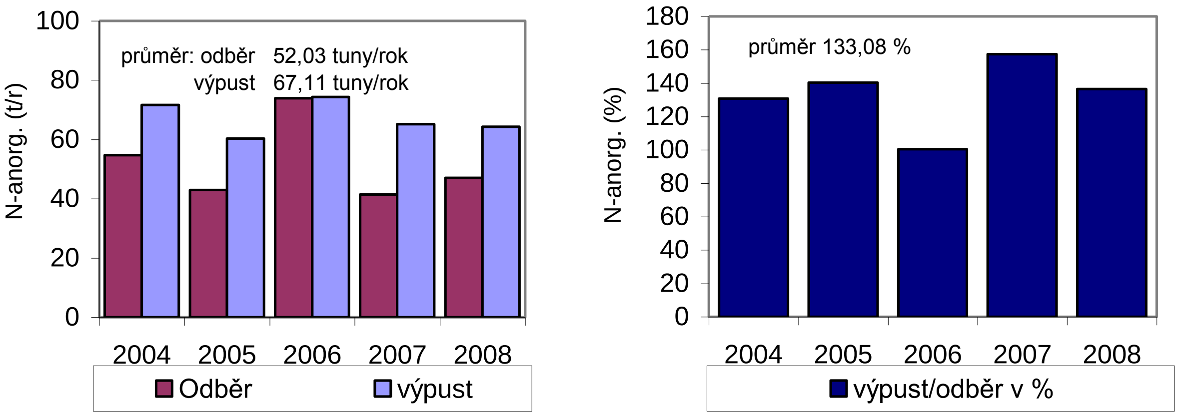


průměr: odběr 694,40 tuny/rok výpust 941,29 tuny/rok	average: consumption 694.40 tons per year discharge 941.29 tons per year
Odběr	Consumption

Výpust	Discharge
SO4 (t/r)	SO4 (t/year)
průměr 135,91%	average 135.91%
výpust/odběr v %	discharge/consumption in %

An increase in the balance in wastewater discharged from NPP Temelín was observed for the sulphates (SO_4^{2-}) indicator. It is probably the effect of raw water clarification, especially for the production of demineralised water, or wastewater clarification, ion exchanger regeneration, etc. The average increase in balance was by 35.9% in comparison with the amount taken in with process water.

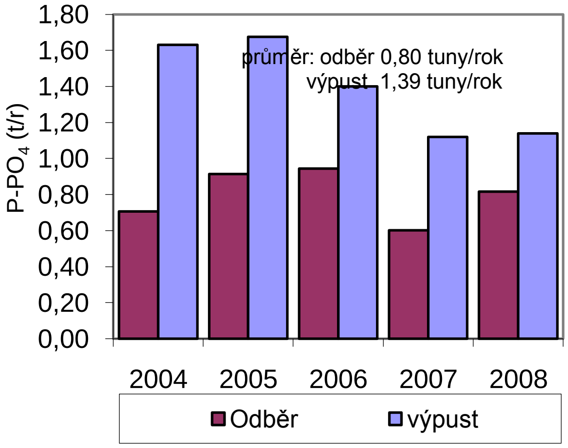
Figure D.I.7: Comparison of balances of inorganic nitrogen (N-inorg.) withdrawn with process water and in wastewater discharged from TNPP, 2004-2008

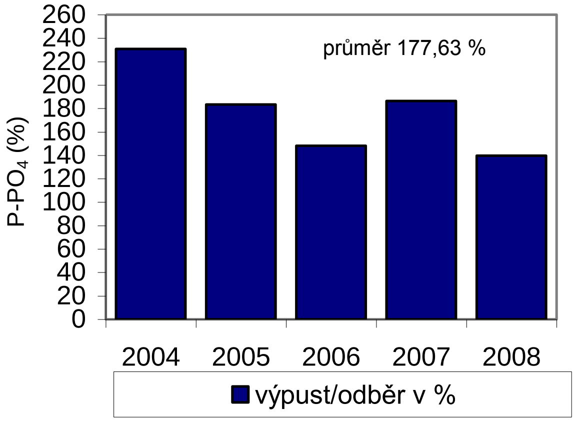


průměr: odběr 52,03 tuny/rok výpust 67,11 tuny/rok	average: consumption 52.03 tons per year discharge 67.11 tons per year
Odběr	Consumption
Výpust	Discharge
N-anorg. (t/r)	N-inorg. (t/year)
průměr 133,08%	average 133.08%
výpust/odběr v %	discharge/consumption in %

Similarly, an average increase of 33.1% in balance was observed for the inorganic nitrogen (N-inorg.) indicator. The increased average share of wastewater from the NPP Temelín wastewater treatment plant was 3.85%.

Figure D.I.8: Comparison of balances of phosphatic phosphorus (P-PO_4) withdrawn with process water and in wastewater discharged from TNPP, 2004-2008

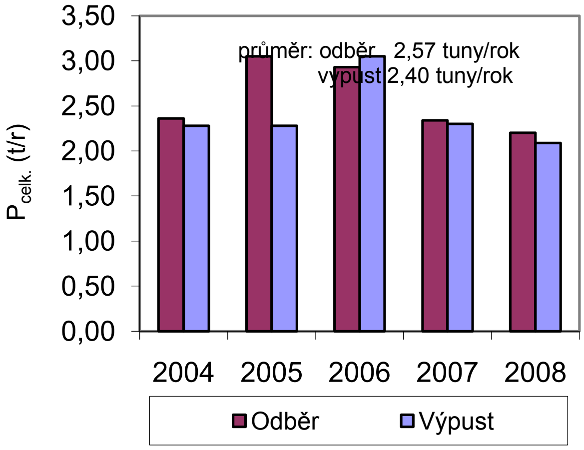


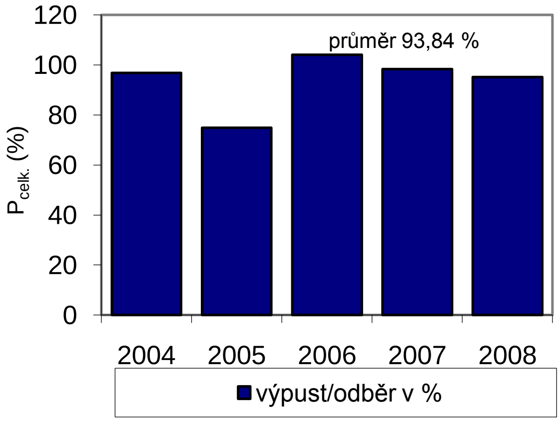


průměr: odběr 0,80 tuny/rok výpust 1,39 tuny/rok	average: consumption 0.80 tons per year discharge 1.39 tons per year
Odběr	Consumption
Výpust	Discharge
P-PO4 (t/r)	P-PO4 (t/year)
průměr 177,63%	average 177.63%
výpust/odběr v %	discharge/consumption in %

An average increase of 77.6% in balance was observed for the phosphatic phosphorus (P-PO_4^{3-}) indicator.

Figure D.I.9: Comparison of balances of total phosphorus ($P_{tot.}$) withdrawn with process water and in wastewater discharged from TNPP, 2004-2008

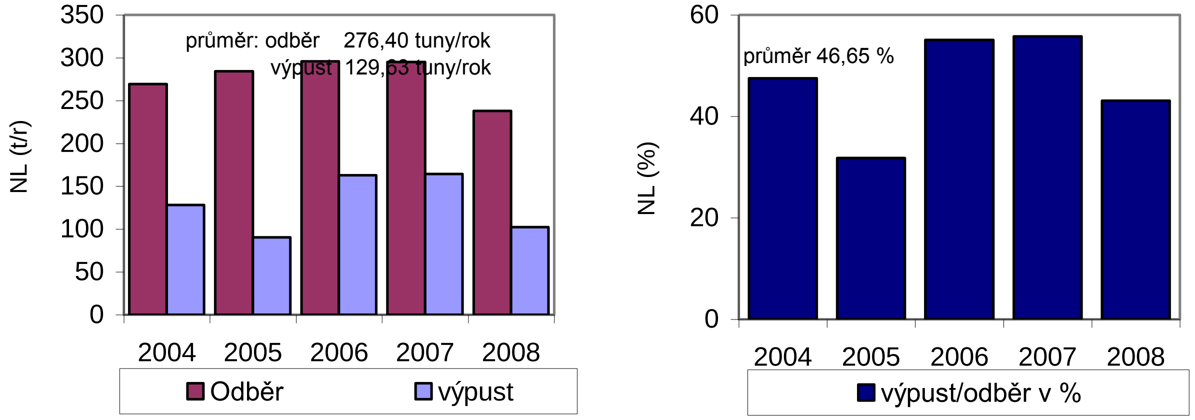




průměr: odběr 2,57 tuny/rok výpust 2,40 tuny/rok	average: consumption 2.57 tons per year discharge 2.40 tons per year
Odběr	Consumption
Výpust	Discharge
Pcelk (t/r)	Ptotal (t/year)
průměr 93,84%	average 93.84%
výpust/odběr v %	discharge/consumption in %

As for the total phosphorus indicator ($P_{tot.}$), the annual average balance in discharged wastewater was found to be 93.8% in comparison with the balance taken in with process water. The ratio of contribution of $P_{tot.}$ in wastewater from the Temelín NPP wastewater treatment plant was relatively significant in the same period, amounting to 28.6% on average in relation to the $P_{tot.}$ balance in all NPP wastewater.

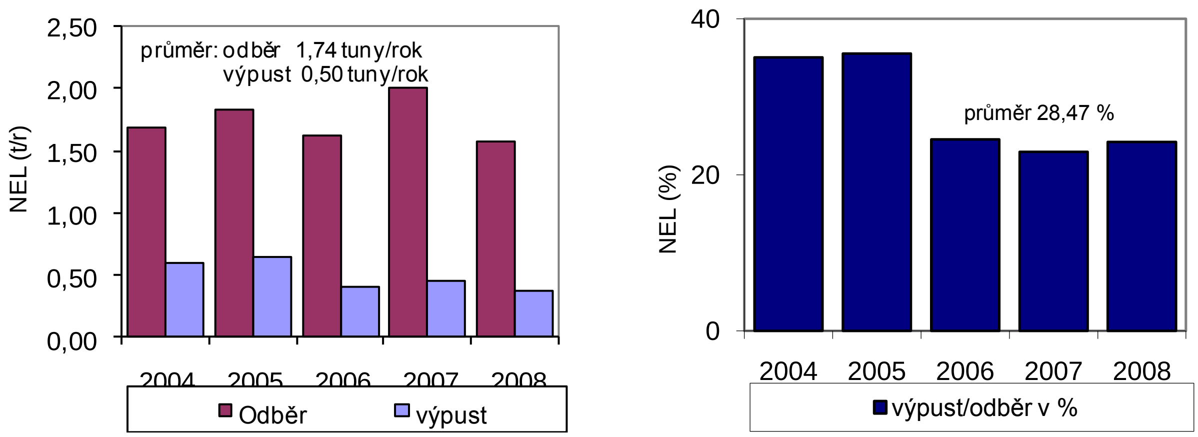
Figure D.I.10: Comparison of balances of suspended solids (SS) withdrawn with process water and in wastewater discharged from TNPP, 2004-2008



průměr: odběr 276,40 tuny/rok výpust 129,63 tuny/rok	average: consumption 276.40 tons per year discharge 129.63 tons per year
Odběr	Consumption
Výpust	Discharge
NL (t/r)	Undissolved substances (US) (t/year)
průměr 46,65%	average 46.65%
výpust/odběr v %	discharge/consumption in %

As for the suspended solids (SS) indicator, its balance in NPP Temelín water economy decreased. The average ratio of SS in discharged wastewater to its balance in withdrawn process water was 46.7%. The concentration and balance of SS decreases due to partial sedimentation and entrapment on process equipment (e.g. after chemical clarification on belt press filters) in NPP Temelín water economy. The contribution of SS balance in wastewater from the NPP Temelín wastewater treatment plant was relatively low, namely 0.90% on average, in relation to the SS balance in all NPP Temelín wastewater.

Figure D.I.11: Comparison of balances of hydrocarbon oil index (HOI) withdrawn with process water and in wastewater discharged from TNPP, 2004-2008



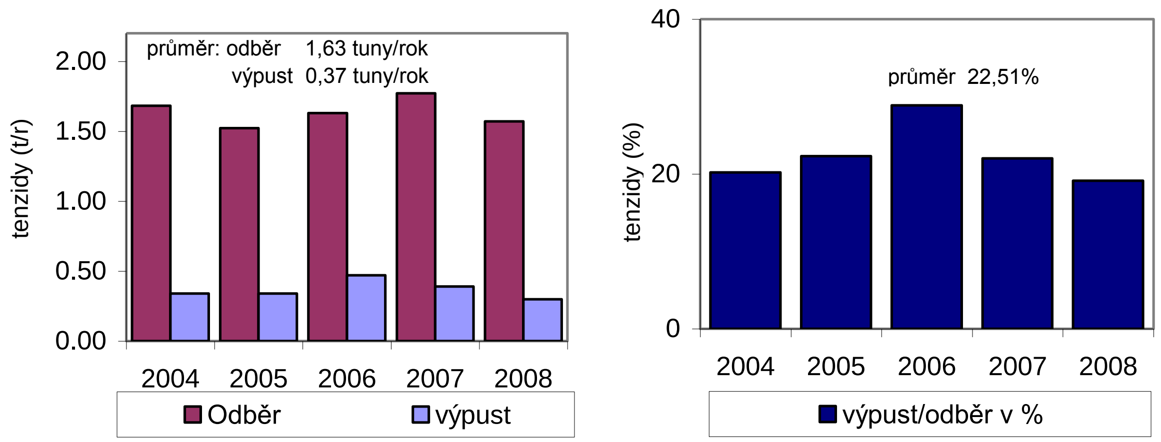
průměr: odběr 1,74 tuny/rok výpust 0,50 tuny/rok	average: consumption 1.74 tons per year discharge 0.50 tons per year

Odběr	Consumption
Výpust	Discharge
NEL (t/r)	NES (t/year)
průměr 28,47%	average 28.47%
výpust/odběr v %	discharge/consumption in %

The “self-cleaning” capacity in the Temelín NPP’s water economy also manifested itself in the hydrocarbon oil index (HOI) indicator. In the period under investigation, the average ratio of discharged and withdrawn HOI was 28.5% (values under the detection limit were included in the calculation of inflow and outflow balances at the detection limit level; the calculated value of decrease in HOI balance should be considered indicative).

Here we should mention ČSN EN ISO 9377-2 (75 7507) Water quality - Determination of hydrocarbon oil index - Part 2: Method using solvent extraction and gas chromatography from 2006. The term “hydrocarbon oil index” is replaced with “hydrocarbons C_{10}-C_{40}” and the abbreviation HOI is no longer used. This is a newly used summary indicator of organic pollution in water, which has already been introduced in water pollution limits as indicator no. 29 labelled C_{10}-C_{40}. The generally required water pollution limit for C_{90} is 0.1 mg/l (the value is met if the annual number of samples that do not comply with this standard is no greater than 10% - value with a 90% probability of non-exceeding). The corresponding annual average is 0.05 mg/l (annual arithmetic mean). Previously applicable regulations used the HOI indicator. Since water use authorisation for wastewater discharge from NPP Temelín specified emission limits for HOI, the determination is still carried out in practice besides the C_{10}-C_{40} indicator. However, the discharged concentrations of HOI are so low (on the edge of the detection limit) that compliance with the limit for C_{10}-C_{40} can be anticipated.

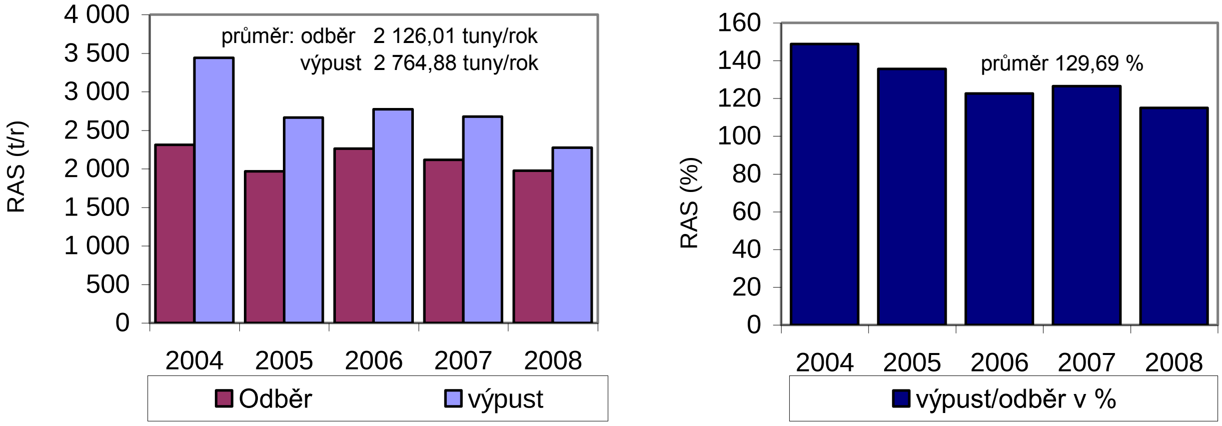
Figure D.I.12: Comparison of balances of anionic surfactants withdrawn with process water and in wastewater discharged from TNPP, 2004-2008



průměr: odběr 1,63 tuny/rok výpust 0,37 tuny/rok	average: consumption 1.63 tons per year discharge 0.37 tons per year
Odběr	Consumption
Výpust	Discharge
tenzidy (t/r) / tenzidy (%)	surfactants (t/year) / surfactants (%)
průměr 22,51%	average 22.51%
výpust/odběr v %	discharge/consumption in %

As for the anionic surfactants indicator, their balance in discharged wastewater also decreased. The average ratio of discharged and withdrawn surfactants was 22.5% in the period under investigation (values under the detection limit were included in the calculation of inflow and outflow balances at the detection limit level; the calculated value of decrease in active surfactants balance should be considered indicative).

Figure D.I.13: Comparison of balances of dissolved inorganic salts withdrawn with process water and in wastewater discharged from TNPP, 2004-2008



průměr: odběr 2126,01 tuny/rok výpust 2764,88 tuny/rok	average: consumption 2126.01 tons per year discharge 2764.88 tons per year
Odběr	Consumption
Výpust	Discharge
RAS (t/r) / RAS (%)	DIS (t/year) / DIS (%)
průměr 129,69%	average 129.69%
výpust/odběr v %	discharge/consumption in %

As for the dissolved inorganic salts (DIS) indicator, which covers a wider range of substances, the average annual ratio of discharged substances to withdrawn substances was 129.7%. The increase in DIS in wastewater discharged from the Temelín NPP is related to the consumption of chemicals during technological operations.

In terms of the share of the balance of substances discharged from the wastewater treatment plant, it can be said that the contribution is generally very low among the monitored indicators. It is 2.68% for BOD_5, 0.94% for COD_{Cr}, 3.85% for N-inorg., 0.90% for SS and the most 28.6% for $P_{tot.}$, where the increase is caused by utility and laundry wastewater.

The introduced quantity of chemicals from NPP operation roughly corresponds to the consumption of selected chemicals and agents. Consumption data for 2008 is shown in the following table.

Table D.I.126: Consumption of selected chemicals and agents in relation to wastewater discharged by NPP Temelín, 2008

Substance	Concentration [%]	Name / active substance	Quantity	Concentration	Consumption [$t.yr^{-1}$]
HNO_3	66	Nitric acid	9.85 m^3	921.3 $kg.m^{-3}$	9.1
NH_4OH	22	Ammonium hydroxide	165.672 m^3	201.6 $kg.m^{-3}$	33.4
NaOH	49	Sodium hydroxide	254.055 m^3	742.9 $kg.m^{-3}$	190
H_2SO_4	96	Sulphuric acid	68.009 m^3	1,762 $kg.m^{-3}$	120
NaCl	-	Sodium chloride	7.96 t	-	7.96
N_2H_4	4.9	Hydrazine	57.1 m^3	49 $kg.m^{-3}$	2.8
H_3BO_3	-	Boric acid	4.8 t	-	4.8
$Fe_2(SO_4)_3$	40	Ferric sulphate	70.973 t	400 $kg.t^{-1}$	28.4
$Ca(OH)_2$	-	Calcium hydroxide	33.718 t	-	33.718
NALCO 7384 phosphate-free	100	Zinc chloride (40-70)	4.500 t	-	4.5
NALCO 23210	100	Sodium bisulphite (1-3)	4.640 t	-	4.6

TRASAR					
3D TRASAR 3DT 149	100	Sodium bisulphite (1-3)	1.190 t	-	1.19
NALCO ST70 STABREX, biocide	100	Alkaline antimicrobial bromine	41.820 t	-	41.82
Detergents 0.600 $t.yr^{-1}$	-	Tripolyphosphate	0.395 t	-	0.395
		Hexametaphosphate	0.094 t	-	0.094

The total balance of added cations and anions in 2008 was 282 t, including 94.5 t of Na^+, 20.4 t of NH_4^+, 2.2 t of Zn, 0.123 t of $P_{tot.}$, 148.8 t of SO_4^{2-}, 9.0 t of NO_3^- and 7.1 t of Cl^-.

A comparison of substances in withdrawn process water and wastewater discharged from NPP Temelín shows that their contents are significantly affected by processes in the NPP, with a considerable decrease (BOD_5, COD, surfactants, etc.) as well as increase (nitrogen, phosphates, etc.) in the balance of some of the substances in wastewater.

For non-radioactive substances, the assessment of the impact of Temelín NPP operation on the watercourse was based on the mean value of the annual balance of individual indicators of substances in wastewater from 2004 to 2008. This summary value includes balances of substances in blowdown from cooling towers and other wastewater, including added chemicals and agents. The average flow rate in the Vltava at the point of wastewater discharge at Kořensko used for the calculation was 50 m^3.

Average water quality c_i after mixing with wastewater from NPP Temelín was calculated for the individual quality indicators in the Vltava at Kořensko, downstream of the wastewater discharge, using the following formula:

$$c_i = \frac{c_{1,i}.q_1 + c_{2,i}.q_2}{q_1 + q_2} = \frac{\frac{m_{1,i}}{t} + c_{2,i}.q_2}{q_1 + q_2} \qquad (1)$$

where:

c_i … average concentration of a water quality indicator i in the Vltava after mixing with wastewater from NPP Temelín [$mg.l^{-1}$],
$c_{1,i}$ … average concentration of a water quality indicator i in NPP Temelín wastewater [$mg.l^{-1}$],
$c_{2,i}$ … average concentration of a water quality indicator i in the Vltava at Kořensko upstream of NPP Temelín wastewater discharge [$mg.l^{-1}$],
q_1 … average flow rate of wastewater from NPP Temelín NPP [$l.s^{-1}$],
q_2 … average flow rate of water in the Vltava at Kořensko [$l.s^{-1}$],
$m_{1,i}$ … average annual balance of a water quality indicator i in NPP Temelín wastewater [mg],
t … the duration of a year [s].

The calculated average concentrations of Vltava water quality indicators c_i were used to calculate the increment in the average concentration of quality indicators in the Vltava at Kořensko, using the formula:

$$\Delta c_i = c_i - c_{2,i} \qquad (2)$$

where:

Δc_i … increment in the concentration of a quality indicator i in the Vltava after mixing with wastewater from NPP Temelín [$mg.l^{-1}$].

Calculated values of the average concentrations and increments in the concentration of quality indicators i in the Vltava at Kořensko after mixing up with wastewater from the NNPP (aggregated with those of the Temelín NPP), the average annual concentrations of quality indicators i in the Vltava upstream of the wastewater discharge and applicable water pollution limits/corresponding annual averages according to Government Decree no. 61/2003 Coll., as amended, or the Guidelines, are included in the aggregate in Annexes thereto.

The calculated values show that the annual averages never exceed the applicable water pollution limits pursuant to the Guidelines. Closest to the mean annual pollution limit is the COD_{Cr} indicator (limit = 25 $mg.l^{-1}$). The mean COD_{Cr} level is 24.8 $mg.l^{-1}$ in the untreated water and 24.94 $mg.l^{-1}$ downstream of the point of discharge into the Vltava (see columns 1, 2 and 3 of the table below).

In addition, relative increments in pollution due to the discharge of wastewater from NPP Temelín were calculated using the formula:

$$rel.\Delta c_i = \frac{c_i - c_{2,i}}{c_{2,i}}.100 \quad (3)$$

where:

$rel.\Delta c_i$ … average increment in the concentration of a quality indicator i in the Vltava after mixing with wastewater from NPP Temelín [%].

With respect to BOD_5, $N\text{-}NH_4^+$ and anionic surfactants, the quality of wastewater discharged from the plant is better than that of the river water at Kořensko (L and R bank average), which implies that the discharge brings about a minor water quality improvement downstream of the waste water discharge point: roughly by 0.1%, 0.2% and 0.01%, respectively. As regards the remaining indicators, on the contrary, the discharge brings about a slight water quality deterioration. The relative increments (quality deterioration) are as follows: COD_{Mn} 0.5%, COD_{Cr} 0.6%, SO_4^{2-} 1.9%, $N\text{-}NO_3^-$ 2.1%, N-inorg. 2.0%, $P\text{-}PO_4^{3-}$ 2.5%, $P_{tot.}$ 0.8%, SS 0.1%, HOI 0.1% and DIS 1.7% (see the following table).

Table D.I.127: Impact of NPP Temelín operation (2x1000 MW_e) on water quality in the Vltava, average values for 2004-2008, and comparison with derived average pollution limits pursuant to the Guidelines

Quality indicator i	Kořensko $c_{2,i}$ 2004-08 average	NPP wastewater $c_{1,i}$ 2004-08 average	Kořensko c_i downstream of NPP	Increment by NPP Δc_i	Derived average limit
	mg.l-1				
BOD_5	3.47	2.53	3.46	-0.004	3.8
COD_{Mn}	8.16	17.36	8.20	0.044	-
COD_{Cr}	24.80	54.53	24.94	0.14	25
SO_4^{2-}	25.10	125.02	25.57	0.47	200
$N\text{-}NH_4^+$	0.15	0.09	0.15	-0.0003	0.23
$N\text{-}NO_2^-$	-	0.05	-	-	-
$N\text{-}NO_3^-$	1.60	8.88	1.63	0.03	4.5
N-inorg. *)	1.75	9.02	1.78	0.03	-
P-PO43-	0.03	0.19	0.03	0.0007	-
$P_{tot.}$	0.12	0.32	0.12	0.001	0.15
SS	13.35	17.00	13.37	0.02	20
HOI	0.05	0.07	0.05	0.00007	-
Anionic surfactants	0.05	0.05	0.05	0	0.3
DIS	81.35	370.67	82.72	1.37	470 **)

*) sum of N-NH4+ and N-NO3-
**) derived average pollution limit for DS ignited at 550°C can be considered synonymous with DIS

Effect of the operation of the NNPP and existing NPP

The prediction of the impact of the individual NNPP power alternatives and NPP Temelín makes use of annual volumes of discharged wastewater from design documents. The quality of wastewater is based on operational experience from NPP Temelín from 2004 to 2008. This means that wastewater quality is the same for all alternatives under investigation but the volumes of discharged wastewater differ. Average values reached in 2004 to 2008 are used conservatively for the quality of water in the body receiving the wastewater, i.e. the Vltava at Kořensko. The quality is expected to improve in the time frame of 2020 and later as a result of sanitation measures in the Lužnice and Vltava basins upstream of the Vltava at Kořensko. Based on this assumption, the quality of water at the point of process water withdrawal at Hněvkovice can be expected to improve as well, reducing the balance/concentration of quality indicators in wastewater from the NNPP and TNPP in comparison with the conservatively applied experience from the current operation of NPP Temelín.

The prediction of the impact of the NNPP and the Temelín NPP on runoffs affected by climate changes makes use of alternative hydrological scenarios for 2020, 2025 and 2085.

The predictions of water quality downstream of the wastewater discharge are calculated for the individual NNPP alternatives and the parallel operation of the NNPP and NPP Temelín using the following formula:

$$c_{i,j} = \frac{c_{1,i}.q_{1,j} + c_{2,i}.q_{2,j}}{q_{1,j} + q_{2,j}} \quad (4)$$

where:

$c_{i,j}$ … average concentration of a water quality indicator i in the Vltava after mixing with wastewater for the individual NNPP power alternatives and parallel operation with NPP Temelín [$mg.l^{-1}$],
$c_{1,i}$ … average concentration of a water quality indicator i in wastewater from the NNPP and parallel operation with NPP Temelín [$mg.l^{-1}$],
$c_{2,i}$ … average concentration of a water quality indicator i in the Vltava at Kořensko upstream of the discharge of wastewater from the NNPP and parallel operation with NPP Temelín [$mg.l^{-1}$],
$q_{1,i}$ … average flow rate of wastewater from the NNPP and parallel operation with NPP Temelín [$l.s^{-1}$],
$q_{2,j}$ … average flow rate of water in the Vltava at Kořensko affected by climate changes and water withdrawal for the individual NNPP power alternatives and parallel operation with the Temelín NPP [$l.s^{-1}$].

The calculated average concentrations of Vltava water quality indicators $c_{i,j}$ are used to calculate the increment in the average concentration of quality indicators in the Vltava at Kořensko, using the formula:

$$\Delta c_{i,j} = c_{i,j} - c_{2,i} \qquad (5)$$

where:

$\Delta c_{i,j}$ … increment in the concentration of a quality indicator i in the Vltava after mixing with wastewater from the NNPP and parallel operation with NPP Temelín [$mg.l^{-1}$].

Calculated values of the average concentrations and increments in the concentration of quality indicators i in the Vltava at Kořensko after mixing with wastewater from NPP Temelín, the average annual concentrations of quality indicators i in the Vltava upstream of the discharge of wastewater from NPP Temelín and applicable water pollution limits / corresponding annual averages according to Government Decree no. 61/2003 Coll., as amended, or the Guidelines for the individual NNPP power alternatives, for the parallel operation of the NNPP and NPP Temelín, for the years 2020, 2025, 2050, 2085 and for all climate development scenarios, are included in Annexes thereto.

The data shows that similarly to the current NPP Temelín operation, derived average pollution limits are not exceeded for any NPP power alternative (even if the climate change according to scenario A, 0, B, C and D is taken into account) in any monitored indicator except COD_{Cr}. While the effect of the current NPP Temelín operation results in an average annual value of 24.97 $mg.l^{-1}$ in the Vltava at Kořensko, the evaluated scenarios of extension and affected flow rates in the Vltava at Kořensko result in annual average values ranging from 25.1-25.4 $mg.l^{-1}$. These are small increments to the concentration of COD_{Cr}. The increments corresponding to climate scenario A are the greatest from this range. The increments are proportional to the discharged amount of wastewater for the individual NNPP power alternatives, including combination with the existing NPP Temelín. It must also be noted that pursuant to Government Decree no. 61/2003 Coll., as amended, no COD_{Cr} emission limits but only permissible surface water pollution limits are defined for industrial wastewater / heat generation and distribution.

For example, for a combination of TNPP+2x1700 MW_e (the greatest volume of wastewater discharged) the impact of the NNPP at the level of 2020 under scenario A results in a predicted COD_{Cr} concentration at a level of 25.4 $mg.l^{-1}$, i.e. by 0.6 $mg.l^{-1}$, or relative deterioration by 2.4% (not considering any positive changes in pollution sources in the Vltava and Lužnice basins upstream of the discharge of wastewater from TNPP+2x1700 MW_e). However, absolute differences between the individual project power output alternatives are very small and insignificant.

At the level of 2025, the project power output alternatives under consideration result in a deterioration in this indicator by no more than 0.56 $mg.l^{-1}$ in relation to the current average water quality in the Vltava at Kořensko.

As for 2085, the greatest increase in this indicator is by 0.46 $mg.l^{-1}$, or by 1.9%.

Since studies to evaluate vertical and transverse mixing in the Vltava at Hladná, where check samples are taken, came to the conclusion that mixing at that point is imperfect, it will be not be possible to verify the low impacts by monitoring in practice; they can only be evaluated by calculation. Annual average concentrations of COD_{Cr} below water pollution limits will be reliably reached in the Vltava at Solenice downstream of the Orlík reservoir dam, even if there is no water quality improvement in the basins of the Vltava, Lužnice and Otava (main tributaries of the Orlík reservoir). The annual average concentrations of COD_{Cr} in the Vltava at Solenice in 2004-2008 were 19.3 $mg.l^{-1}$, 19.6 $mg.l^{-1}$, 21.7 $mg.l^{-1}$, 14.8 $mg.l^{-1}$ and 15.8 $mg.l^{-1}$.

Nevertheless, the wastewater treatment plant for the operation of NPP Temelín 1, 2, 3, 4 will need to use the necessary technology to be able to ensure as efficient treatment as possible under economically and technically acceptable conditions.

Positive changes in quality development in the Vltava basin upstream of the point of process water withdrawal at Hněvkovice by 2020 and later would be reflected in an improvement in the quality of withdrawn water and thus in an improvement in the quality of discharged wastewater. An improvement in water quality in the Lužnice basin in the same period would result in an improvement in water quality at the point of wastewater discharge to the Vltava at Kořensko.

D.I.4.1.4. Impact on water temperature in the Vltava downstream of wastewater discharge

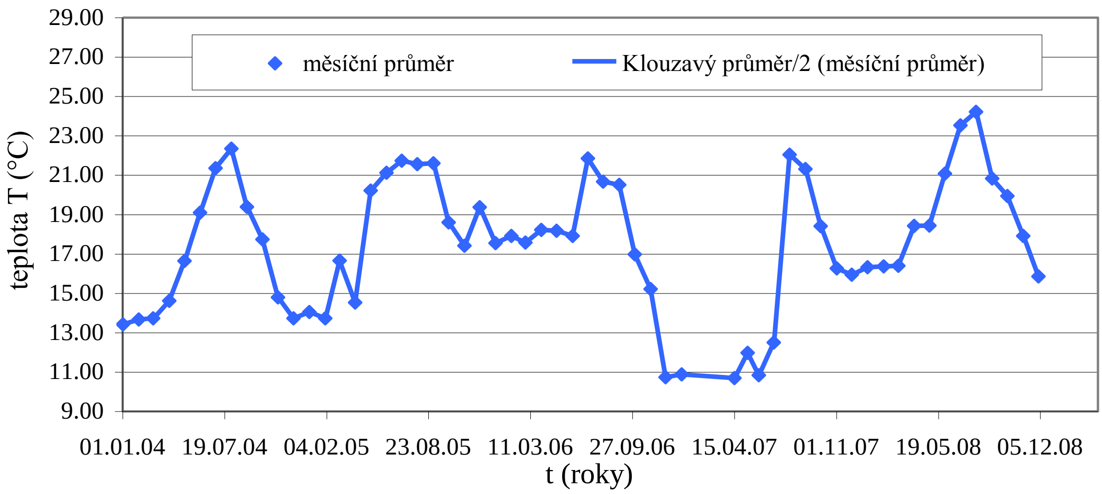
PROJECT (UNITS 3+4)

Calculated annual average water temperatures in the Vltava at Kořensko downstream of wastewater discharge for the individual NNPP power alternatives and for the parallel operation of the NNPP and the existing NPP are commented in the following section, discussing the power plant as a whole (units 1+2+3+4). The expected effect on water temperatures in 2025, 2050, 2085 for all climate change scenarios are calculated in a similar way. The data is available in Annexes hereto.

PLANT (UNITS 1+2+3+4)

Data from the continual measurement of the temperature of wastewater released from NPP Temelín in 2004-2008 was used for the required assessment of the overall effect of the existing NPP and the NNPP. Running averages of monthly temperatures are charted in the following figure.

Figure D.I.14: Development of running averages of NPP wastewater temperatures, 2004-2008



Teplota T	Temperature T
t (roky)	t (years)
Měsíční průměr	Monthly average
Klouzavý průměr/2 (měsíční průměr)	Sliding average/2 (monthly average)

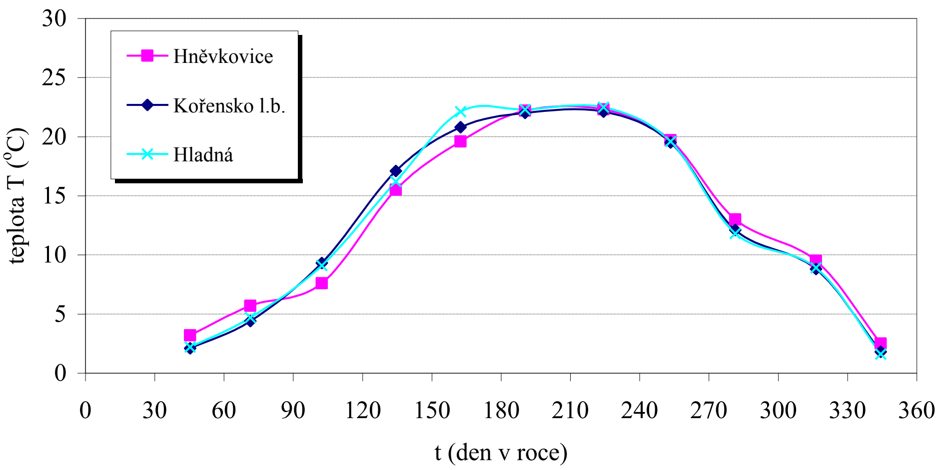
The assessment of the impact of the current operation on the thermal pollution of the Vltava downstream of the NPP Temelín wastewater discharge used an average daily wastewater temperature of 17.88°C from the period of 2004-2008. The average water temperature in the Vltava at Kořensko (L and R bank average) was 11.3°C from the same period. The calculation of the resulting water temperature in the Vltava downstream of the wastewater discharge and temperature increments due to NPP Temelín operation used the above formulas (1), (2) and (3), replacing substance concentration c with water temperature T.

With the current operation, the resulting water temperature in the Vltava after mixing with wastewater from NPP Temelín is 11.33°C on average and the increment in temperature is 0.03°C. Thermal pollution is thus relatively low and it is difficult to evidence an increase by measurement because NPP wastewater is not mixed well transversely and vertically at the nearest measurement point at Hladná.

Water temperature in the Vltava downstream of the NPP wastewater discharge is thus significantly lower than the pollution limit c_{90}, or the corresponding annual average, which is 14°C pursuant to Government Decree no. 61/2003 Coll., as amended, and the Guidelines.

The low impacts of NPP Temelín's discharged heated wastewater are documented by the results of temperature measurements in the Vltava at Hněvkovice, Kořensko (L and R bank average) and Hladná, for example in 2008 as shown in the Figure below.

Figure D.I.15: Seasonal development of water temperature in the Vltava at Hněvkovice, Kořensko and Hladná, 2008



Teplota T	Temperature T
t (den v roce)	t (day in year)

The assessment of the impact of the individual NNPP power alternatives in parallel operation with the existing NPP on the thermal pollution of the Vltava downstream of their wastewater discharge used the average daily wastewater temperature of 17.88°C from the period of 2004-2008 for the existing NPP. The average temperature of wastewater from the NNPP is 16.93°C according to design documents. The average water temperature in the Vltava at Kořensko (L and R bank average) under consideration is the same as the average of 2004-2008 namely 11.3°C. The calculation of the resulting water temperature in the Vltava downstream of the wastewater discharge and temperature increments due to NPP Temelín operation used the above formulas (1), (2) and (3), replacing substance concentration c with water temperature T; contributions from wastewater from the existing NPP and from wastewater from the NNPP were calculated separately for the combination of wastewater from the existing NPP and the NNPP.

Calculated annual average water temperatures in the Vltava at Kořensko downstream of the wastewater discharge for the individual NNPP power alternatives and for the parallel operation of the NNPP and the existing NPP for 2020 to 2085 for all climate development scenarios are available in the Annexes hereto.

The results show that the average increase in water temperature in the Vltava is very low for all estimated effects on water flow rates in the Vltava at Kořensko (for climate scenarios A, 0, B, C and D). The temperatures calculated for the individual NNPP power alternatives in combination with the existing NPP at the level of 2020 range from 11.43-11.47°C (an increase of 0.13-0.17°C), with differences between the scenario in hundredths of °C.

Like with the other water quality indicators (see above), the relatively highest impacts result from the combination of the existing NPP+2x1600 MW_e because this power output alternative discharges the highest volume of wastewater. At the level of 2025, increased temperature values in the Vltava for NPP Temelín + the NNPP range from 11.43-11.45°C.

At the level of 2085, values ranging from 11.36-11.39°C (an increase of 0.06-0.09°C) are calculated for the NNPP alternatives and climate scenarios under investigation. The resulting temperature is thus much lower than the pollution limit of 14 °C pursuant to Government Decree no. 61/2003 Coll., as amended, and the Guidelines.

D.I.4.2. Impacts on groundwater

Two groundwater horizons exist in the area in question:

- a shallow circulation horizon, bound to Quaternary sediments and a surface zone of eluvia, which was hit (usually with varying and low inflow intensities) mostly at the Quaternary-eluvium interface or at the basis of the eluvium, especially during the spring thaw or increased precipitations, and
- a fissure groundwater horizon in rocks below the level of foundation of main structures.

Extraction capacities in the area are in the order of tenths to hundredths of litres per second. No higher groundwater extraction either for water supply or process purposes is feasible here.

PROJECT (UNITS 3+4)

Since groundwork has mostly been finished already (the shallow groundwater horizon in Quaternary covers was largely excavated during the rough grading of the current power plant site), minimum effect on the existing surface runoff can be expected after the power plant extension is finished.

The buildings of the NNPP are similar to those already existing, so no major effect on the hydrogeological conditions can be expected. The implementation of the project will only locally result in changes to infiltration conditions and a reduction in precipitation water catchment. The drainage system will be similar to the existing one. No major effects on the wider surrounding area are expected.

The area in question does not include any protected areas of natural groundwater accumulation or groundwater sources that might be disturbed by project implementation.

Considering the type of hydrogeologic structure, the project as a whole cannot disturb or affect the hydrogeological situation. Changes in groundwater flows and the creation of very shallow aquifers in the backfills of linear excavations and individual structures can be eliminated by draining and making backfills of compacted earth whose permeability after processing will be identical to or less than the permeability of the surrounding and underlying rock environments.

PLANT (UNITS 1+2+3+4)

The above assessment applies both to the existing situation and to the power plant after extension. Effects on the wider hydrogeological situation will be comparable to those already existing.

The current monitoring of groundwater level shows that there are no major changes in the wider hydrogeological situation. The shallow groundwater system is the only one that can be considered potentially effectible. The mean shallow circulation system ground water levels in the monitoring boreholes in the plant surroundings and in some boreholes in the Temelínec dumping ground area were up to one metre lower during the 2001-2008 period than in the pre-operational period. The descending tendency of the groundwater level is apparent at sites where groundwater surfaces as a small water leak, e.g. at the Temelínec dumping ground. A slightly descending tendency of the ground water levels also occurs in the area of the monitoring boreholes to the northwest of the plant, where no such leaks occur. The share of precipitation infiltration, or subsurface runoff, decreased in the last year of monitoring, affecting the overall trend in the plant surroundings. Based on the above facts, the ground water regime is affected slightly by the draining of the plant area. However, the contribution of the draining of the surfaces to this effect cannot be ascertained.

Long-term ground water quality monitoring, carried out as part of the monitoring of the current plant's operation, and comparison between values from the pre-operational and operational period do not indicate any major impact of the nuclear plant's operation on changes in chemical quality indicators. The indicator values range between acceptable maxima and minima. The occasional occurrence of peak values during monitoring is practically unexplainable since the frequency of observation does not allow it. Indicator development trends are indifferent, as their values fluctuate about averages. Analysis leads to the conclusion that groundwater quality is unaffected by the normal operation of the plant in any way. In general, the variability of indicator values can be ascribed to the composition of the geologic environment, rainwater quality and ground water flow velocity, as well as to farming on agricultural land around the plant. It is therefore not probable for the new plant operation to affect groundwater quality. An insignificant temporary change in groundwater quality could only occur during the construction.

Specific activity monitoring in the plant area and in its nearest surroundings did not reveal any significant change indicating any significant long-term effect of the nuclear power plant on the ground water activity. Specific activities of tritium and caesium 137 are permanently below their limits of detection.

Since there are no water sources, no water sources will be affected.

The area in question does not include any protected areas of natural groundwater accumulation or groundwater sources that might be disturbed by project implementation.

D.I.4.3. Impacts during the preparation and implementation period

No impacts that might result in significant negative impacts on surface or ground water are expected during the construction period.

Logically, there will be potential risk factors for surface/ground water contamination at the construction site and in its vicinity. This involves in particular possible contamination by oil hydrocarbons that may leak from construction machinery and trucks. These impacts can be minimised or eliminated completely by suitable measures, which are largely based on applicable legislation, and by observing good technical practice.

D.I.4.4. Impacts in the shutdown period

No additional impacts beyond the scope of those described above can be expected in the shutdown period.

D.I.5. Impacts on soil

D.I.5.1. Impacts on land appropriation

PROJECT (UNITS 3+4)

Land plots for the NNPP construction are located west of the existing NPP Temelín site in its close proximity. In line with the original NPP Temelín construction project involving four nuclear units, appropriated land included plots for units 3+4, which were not constructed. The NNPP will thus be constructed on plots originally intended for the construction of units 3 and 4, which have already been permanently unregistered as agricultural land resources, and on adjacent new plots that are going to be permanently unregistered as agricultural land resources. The land intended for the NNPP construction is anthropogenically affected, the surface is covered by an unoriginal humic cover created on landfills deposited in the area during the construction. The rest of the NNPP construction site lacks the top humic layer of soil cover, transferred from the reclaimed area near Temelín. This is mostly land used for site facilities during the construction of units 1+2, with no VSEU codes assigned, so identifying its protection class and soil quality is impossible. None of the land plots that will be used for project implementation belong to agricultural land protection class I.

Land intended for power output needs to be permanently unregistered from agricultural land resources only to a minimum extent, as this will only concern parts of land plots used for the construction of overhead line pylons.

The raw water supply line itself will not require permanent land appropriation.

PLANT (UNITS 1+2+3+4)

After project implementation, the power plant will have no impact on land appropriation beyond the scope described above.

D.I.5.2. Impacts on soil pollution

PROJECT (UNITS 3+4)

Soil around the plant consists prevailingly of cambisoils, which are susceptible to anthropogenic pollution. The operation of the projected plant will not result in any significant introduction of foreign substances into the soil environment and soil pollution. During NNPP operation, environmental constituents will be subject to regular monitoring, which was already started before the NPP Temelín units 1 and 2 were put into operation.

PLANT (UNITS 1+2+3+4)

The current soil quality situation in the area in question is subject to regular monitoring. Results obtained so far indicate that no impact of NPP Temelín operation can be demonstrated at monitored points around the plant; the situation will remain the same when all of the plant's nuclear units are in operation.

D.I.5.3. Impacts on soil stability and erosion

PROJECT (UNITS 3+4)

The project area is not at risk from landslides or undermining. The project will not result in any change to the existing situation in the area. Neither construction nor operation under the project will impair soil stability; the soils in question will not be subject to erosion.

PLANT (UNITS 1+2+3+4)

The extended plant's operation will neither impair soil stability nor result in any significant erosion.

D.I.5.4. Impacts during the preparation and implementation period

Land that will be used for site facilities will have to be temporarily unregistered from agricultural land resources during the construction. This concerns mostly land plots that were previously used for site facilities during the construction of units 1 and 2; the soils are anthropogenically affected and are reclaimed at the moment. Topsoil will be removed from the affected land, in a thickness according to a pedological survey, and deposited at repositories to be reused for the reclamation of affected land after the construction. Impacts during the preparation and implementation period will be significant (the areas are rather large) but temporary; the land will be reclaimed and the original use of the plots will be restored after the construction.

As for power output, the land will be used for non-agricultural purposes only temporarily, for less than one year, including the time needed for restoration. Moreover, the extent of land appropriation for power output will be reduced by routing the entire line along an existing line. Likewise, the possible construction of a new raw water supply capacity will require only temporary land appropriation. The groundwork, i.e. pipe laying and land reclamation, is supposed to take less than a year. These impacts are not significant.

D.I.5.5. Impacts in the shutdown period

After the end of NPP Temelín operation, plant structures on the land in question will be demolished, or possibly preserved. The freed land will be then used for an unspecified purpose or reregistered as land resources and cultivated. No significant soil contamination can be expected.

D.I.6. Impacts on the rock environment and natural resources

D.I.6.1. Impacts on the rock environment

PROJECT (UNITS 3+4)

The NNPP construction site is located on a compact block that is not disturbed by any fault structures. The Quaternary cover at the construction site was removed during rough grading for the first NPP Temelín construction. The foundation base of NNPP structures consists of crystalline rocks, same as for the existing power plant. Performed surveys and actual construction work showed a monotonous lithological development in the Moldanubic complex and similar properties of its rocks. They only change in connection with the degree of decay and fracture.

Geological conditions in the area will not be affected by project implementation. Considering the characteristics of subsoil rocks, hydrogeological conditions at the construction site, method of earth works and backfilling, adjustments at foundation bases and designed building foundations, there is no risk of a loss of stability or liquefaction of subsoil materials.

PLANT (UNITS 1+2+3+4)

What was said above can also be applied to the power plant after expansion. Buildings and building foundations (will) represent a relatively small foreign element in the geological structure of the area, with no subsequent impacts on its quality.

D.I.6.2. Impacts on natural resources

PROJECT (UNITS 3+4)

There is no mining area or protected mineral estate in the area concerned. The area of interest does not overlap with any mineral deposits and mineral resources in the wider area will be neither affected nor impacted by the project.

PLANT (UNITS 1+2+3+4)

The expanded plant will have no impact on natural resources.

D.I.6.3. Impacts on geological and paleontological heritage

PROJECT (UNITS 3+4)

Any damage to, loss of or impact on geological and paleontological heritage, stratotypes, etc. is excluded at the construction site.

PLANT (UNITS 1+2+3+4)

The expanded plant will have no impact on geological/paleontological heritage.

D.I.6.4. Impacts during the preparation and implementation period

The rock environment and bedrock will be intervened during excavation and the construction of foundation bases and then during the construction of individual building foundations. The intervention in the rock environment is assessed as insignificant.

The crucial factor in the assessment of the mutual impact of the construction and the bedrock will be the geomechanical condition of the bedrock. Soil and rock categorisation, including classification into geotechnical types, was already performed in the area of interest during previous surveys and is assessed in detail in older survey documents. This information will be updated during additional engineering geological studies, which will determine the modulus of deformation E_{def} of the bedrock and indicate any zones with rocks that might have unfavourable physical and mechanical properties. Those would have to be removed from the foundation bases; this impact is assessed as insignificant in terms of the effect on the rock environment.

D.I.6.5. Impacts in the shutdown period

Building foundations will remain in their place in the area; no additional impacts on the rock environment, natural resources or geological/paleontological heritage are expected.

D.I.7. Impacts on fauna, flora and ecosystems

D.I.7.1. Impacts on fauna, flora and ecosystems

PROJECT (UNITS 3+4)

This section always summarises the impacts of the NNPP Temelín construction itself, the reconstruction of the supply line from the Hněvkovice reservoir and the construction of the connection to the Kočín switchyard. An exception is the aquatic environment (hydrobiology and ichthyology) where forecasts of changes in water quality are assessed in relation to the operation of the existing NPP Temelín and the

NNPP. Due to the nature of the biotic constituents of the environment, the impacts of the operation of the new units cannot be assessed separately. Therefore, the impacts of the operation of the NNPP are assessed in combination with the existing NPP Temelín operation below, in a section discussing the operation of the entire plant (units 1+2+3+4).

The assessment relates to the power alternatives of 2x1200 MW_e, 2x1700 MW_e with two cooling towers per unit as well as 2x1200 MW_e with one cooling tower per unit. There are only minute differences between the alternatives in terms of their impacts on fauna, flora and ecosystems.

D.I.7.1.1. Flora (project)

If the project is implemented, i.e. the NNPP Temelín is constructed, the supply line from the Hněvkovice reservoir is reconstructed and the connection to the Kočín switchyard is constructed, vegetation will be affected by the following impacts:

- Temporary mechanical disturbance of a portion of soil surfaces and vegetation at the current NPP Temelín inner site and occlusion of some of the area (sub-area no. 1). A portion of the area will be lost for vegetation permanently. The portion of the area that will be temporarily disturbed by moving machinery will be restored to the same condition as today after the construction and then it will be maintained in the same way (mowing) as today.
- Complete clearance of an old excavation, which was made in the late 1980s with the intention of constructing NPP Temelín units 3 and 4. The area will be filled with inert material (currently located in repositories at the edge of the area) and used for the construction of cooling towers for the NNPP Temelín. In the botanical survey, this area is part of sub-area no. 2.
- Temporary mechanical disturbance of soil surfaces and vegetation on the route of the water supply line from the Hněvkovice reservoir during the reconstruction of the existing line, sub-area no. 3. This corridor was disturbed in a comparable manner by the initial feeder construction twenty years ago. The area will be restored to its original condition after the planned reconstruction. Provided that the risk associated with the propagation of invasive plant species is attended to, the impact of the intervention can be expected to be fully reversible.
- Mechanical disturbance of soil surfaces and vegetation during the reconstruction of the water line and power output to the Kočín switchyard at sub-areas no. 3 and 4.
- Permanent spot occlusion at several small spots (footings of high-voltage line pylons) in the corridor from NPP Temelín to the Kočín switchyard and temporary mechanical disturbance of soil surfaces and vegetation by moving construction machinery during the construction of pylons and installation of conductors (sub-area no. 4). The high-voltage evacuation route is specified as a corridor, without detailed route specification. If the construction is located in its westernmost position, a forest stand will be removed (or kept at a height below 3 m) in a small area of tens of square metres within a buffer zone of 20 m from the outside wire. The loss of the stand is considerably lower than 1% of the forest and does not represent an irreversible damage to the stand as an ecosystem. The intervention in the forest stand is just one of the possible variants of line routing; the high-voltage line will not interfere with the forest in the other variants within the specified corridor. Except for the small areas of pylon footings, the entire high-voltage line construction area will be restored to its original condition; the intervention is temporary and almost completely reversible in relation to vegetation.

Direct impacts on identified taxa and communities

Negative impacts (loss of a biotope, direct intervention in a habitat):

A complete loss of a biotope across the entire range of species at a portion of sub-area no. 2 (waterlogged old excavation pit). As for important plant species, this will result in the disappearance of local populations of the following species from the Red List of the Czech Republic (specially protected species were not found):

- *Centaurium erythraea* - common centaury,
- *Epilobium palustre* - marsh willowherb,
- *Utricularia australis* - bladderwort,
- *Veronica scutellata* - marsh speedwell,
- *Odontites vernus* - red bartsia.

Among the above-mentioned species, only the bladderwort and red bartsia have isolated occurrence in this partial area; the other species can be found at least in one other area (the common centaury at all four sites). This intervention must be assessed as an irreversible change.

Mechanical disturbance of plant communities with the risk of invasion by geographically non-native species at sub-areas no. 1, 3 and 4. This applies to the following important species:

- *Centaurium erythraea* - common centaury, at sub-areas no. 1, 3, 4,
- *Epilobium palustre* - marsh willowherb, at sub-area no. 4,
- *Filago arvensis* - field cottonrose, at sub-area no. 1,
- *Thalictrum lucidum* - shining meadow rue, at sub-area no. 3,
- *Veronica scutellata* - marsh speedwell, at sub-area no. 3,
- *Vulpia myuros* - rat's tail fescue, at sub-area no. 1.

A temporary and, with adequate measures, completely reversible change.

Mechanical disturbance of partial areas during the construction of voltage evacuation lines to the Kočín switchyard at sub-area no. 3. This applies to:

- *Centaurium erythraea* - common centaury,
- *Epilobium palustre* - marsh willowherb,
- *Thalictrum lucidum* - shining meadow rue,
- *Veronica scutellata* - marsh speedwell.

This is a temporary and, with adequate treatment after the construction, completely reversible change.

Possible deforestation of a small forest patch under the high-voltage line to the Kočín switchyard at sub-area no. 3. No important plant species affected. Small-scale permanent irreversible change.

Mechanical disturbance of surfaces by moving construction machinery in all construction areas. Applies to all sites under investigation. A temporary and, with adequate measures, completely reversible change.

Positive impacts (expected improvement - development of populations):

The mechanical disturbance of soil surfaces on a trophically poor substratum opens up free space for a number of plant species that cannot exist without such an intervention permanently (without repeated interventions) in competition with species with stable and mature communities (so that they become rare). Unless the mechanically disturbed areas are reclaimed by depositing trophically rich soils, the initial succession stages at such spots can be temporarily rich in mostly rare, competitively weak species. This applies especially to the NPP Temelín inner site (sub-area no. 1) and also to construction work on the power output lines to the Kočín switchyard (sub-area no. 4) and the water supply line from the Hněvkovice reservoir (sub-area no. 3).

Indirect impacts on identified taxa and communities

Negative impacts (loss of a biotope, direct intervention in a habitat):

No significant indirect impact that would cause the loss of a biotope or disappearance of any of the identified plant populations was identified.

Positive impacts (expected improvement - development of populations):

The project’s positive impact on individual plant populations or plant communities cannot be demonstrably confirmed at the site of the NNPP and its infrastructure under consideration.

D.I.7.1.2. Fauna (project)

D.I.7.1.2.1. Hydrobiology

The impacts of the operation of the new units on aquatic invertebrates are assessed in combination with the existing NPP Temelín operation below, in a section discussing the operation of the entire plant (units 1+2+3+4).

D.I.7.1.2.2. Entomology

Direct impacts

Negative impacts (loss of a biotope, direct intervention in a habitat)

Sub-areas no. 1 and 2 - NPP Temelín site and its immediate surroundings. The implementation of the investment project for the construction of new nuclear power plant units will have an effect on a large area in the close vicinity of the existing power plant site at sub-area no. 2 as well as on a portion of the inner site at sub-area no. 1 and at side study sites. A large area will have its current soil cover destroyed, its surface levelled and a stable subbase created for the construction of new facilities. This can be expected for sub-area no. 2, where the future cooling towers will be located, and at sub-area no. 1, inside the currently closed area where the reactors will be constructed. It is a portion of sub-area no. 2, especially its western part, which unambiguously has the highest habitat and species diversity and is even a biotope with some specially protected and endangered insect species. Due to mass movements, project implementation will cause the loss of some biotopes, especially a secondary wetland at the site of the abandoned excavation for the originally planned construction of cooling towers for units 3 and 4 from the 1980s and the adjacent area with newly created earth repositories. There is not any site with similar parameters in the close vicinity of NPP Temelín, especially for the communities of insects dependent on water bodies and waterlogged areas, and replacement will have to be found by creating suitable substitute habitats whose distance from the construction site should be no more than hundreds of metres, several kilometres at most. In terms of the effect on local spots inside the NPP Temelín site and in its close vicinity, such spots are assessed in detail below:

- Detailed research site F: Fenced-in NPP Temelín site - maintained grassed areas

  No major changes in the use of the NPP Temelín site should occur in connection with the planned construction of new units, except for small structures occupying rather insignificant areas of grassed land and using existing structures. Therefore, no significant negative impacts on the populations of identified bumblebee species are expected because there will be no radical changes in the maintenance of most areas.

- Detailed research sites H and I: Area intended for the construction of reactors (I) and cooling towers (H)

  Project implementation will result in the total destruction of most wetland ecosystems here. Species dependent on a water environment would therefore totally disappear from this area unless a substitute biotope with similar parameters is created in the close vicinity. However, the construction would certainly have a very significant impact on populations of endangered invertebrate species. Species dependent on drier biotopes would not be endangered so much by project implementation, as at least a part of their populations could move to suitable biotopes in the vicinity during the construction. However, the species, except bumblebees, cannot be expected to re-colonise future landscaped areas, which means that the greater part of their biotope would also be destroyed.

- Detailed research site A: Ruderal area near the dumping site

  The area, together with the adjacent dumping site, will probably become part of the site facilities or it will be subject to grading in connection with the construction of a new fence. In any case, this would probably destroy the greater part of the area, which is however not very unique in the context of its neighbouring habitats. Therefore, possible construction impacts do not represent uncompensatory endangerment of populations of specially protected invertebrate species.

- Detailed research site B: Land used for agriculture

  The construction process, in this case occupancy by site facilities, will probably not result in significant endangerment of populations of specially protected or endangered insect species.

- Detailed research site C: Reclaimed grassland and ruderal areas

  The construction (occupancy by site facilities) will result in a serious change in natural conditions and site destruction but there is also an expectation that similar biotopes will be preserved in close proximity, depending on the size of the area occupied.

- Detailed research site D: Maintained grassland near the NPP Temelín site

  Project implementation does not probably represent significant endangerment of populations of specially protected or endangered insect species in this area.

- Detailed research site E: Land plots used mostly for agriculture and their edge areas

  The construction should not seriously endanger populations of the specified specially protected species, if only for the reason that agricultural land with similar features can be found in the wider area. If the project includes only the installation of a new power line to the Kočín switchyard in this area, its impact can be considered local (pylon footings) and generally negligible.

In addition, the assessment involved larger areas that correspond to specified sites affected by the renovation of the water supply line and the construction of a high-voltage line to the Kočín switchyard.

Sub-area no. 3 - water line route. An entomological survey in this rather large area documented a wide range of invertebrates, even if they are mostly common field and meadow species. Field crops near NPP Temelín do not represent any highly valuable biotopes from the environmental point of view; like in the rest of the area, only 2 common bumblebee species of the genus *Bombus sp.* occur rarely there. The nearby pond will not be affected by the construction and the local and temporary effect on field habitats does not pose any threat. A relatively valuable section can be found in the highest part of the route, where grassland meets with a forest. In addition to the already mentioned bumblebees and ants, species found here included the endangered wasp *Polistes bischoffi* (listed as endangered in the Red List), wasp *Argogorytes mystaceus* (listed as endangered in the Red List), green tiger beetle *Cicindela campestris* (specially protected species categorised as "endangered") and checkered beetle (*Trichodes apiarius*), which is disappearing from our country. The possible construction would have a more significant negative impact in this section, especially in the sections "Litoradlice" and "U Bočků". Above the village of Litoradlice, there is a potentially endangered small waterlogged area under a firing range, which should be circumvented during the water line construction. There will also be negative effect on the meadow at the highest section of this part and a secondary biotope in the maintained clearance, depending on the actual location of the standby supply line. However, the negative impact will be local and temporary in terms of entomofauna. If the original characteristics of the biotope are restored when construction work has been finished, the original insect community can be expected to recover.

Sub-area no. 4: Power output to the Kočín switchyard. The performed survey documented occurrence of mostly common agrocenosis species. A large portion of the area consists of intensively managed farming land. At two points the planned construction approaches existing forests, passing by several islands of self-sowing woody plants and grassland. Several specially protected species were documented in the transitional biotopes: rare occurrence of the ground beetle *Carabus scheidleri*, two common bumblebee species of the genus *Bombus sp.*, ant *Formica rufibarbis* and rose beetle *Oxythyrea funesta*. All of the species are rather common and not directly endangered, even though they are still categorised as "endangered species" by Decree no. 395/1992 Coll., as amended. They probably occur in the wide surroundings of the assessed route and project implementation should not significantly affect their populations. Likewise, no species other than those commonly occurring in such biotopes were found on the waterlogged meadow in the southern part of the area. The nature of the construction is not very risky for invertebrates. It is construction of an overhead line, so the expectable impact on their populations is only local and temporary (during the construction period), definitely not devastating for the populations.

Positive impacts

A number of the identified insect species, including specially protected and endangered species (Czech Red List), use areas from which vegetation has been more or less removed as their biotopes. Such areas are formed commonly during construction activities (soil removal, repositories, excavations, areas travelled by heavy machinery) and constitute temporary but usually rather good refuge for the survival of those species in our nature. Such transitional biotopes will be formed during the extensive construction activities at the NPP Temelín site in connection with the addition of the NNPP and infrastructure modifications. Not only will they allow the species found during the survey to survive but we also cannot exclude the possibility that new species will occur there during the construction period, such as the green tiger beetle *Cicindela campestris Linnaeus*, 1758 (specially protected species categorised as endangered) and species from the Red List such as the *Polistes spp*. or *Argogorytes spp* wasps.

The construction of the power output line to the Kočín switchyard and the renovation of the water supply line do not have any positive impact on entomofauna.

D.I.7.1.2.3. Malacology

Direct impacts on identified taxa and communities

Negative impacts (loss of a biotope, direct intervention in a habitat)

The construction of cooling towers in sub-area no. 2, collection point no. 1, must be considered a direct impact accompanied by a loss of biotope. The other collection points will not be affected by the construction to an extent changing the range of mollusc species in the region.

Positive impacts (expected improvement, development of populations):

The assessed project cannot be expected to have any positive impact on malacofauna.

D.I.7.1.2.4. Ichthyology

Impacts on fish in the Vltava and the effect on water quality are dealt with in combination with the existing NPP Temelín operation below, in a section discussing the operation of the entire plant (units 1+2+3+4).

The impact of the planned construction will not significantly affect fish in any of the reservoirs under investigation. The only location that will be completely destroyed by the construction is a system of aquiferous residual depressions from the excavation of foundation for the cooling towers. The area is however free of any fish population.

The possible construction should not significantly impact any fish populations at other sites either. All construction work is planned in a sufficient distance from water bodies with fish populations.

D.I.7.1.2.5. Herpetology

Direct impacts of the assessed project

Negative impacts (loss of a biotope, direct intervention in a habitat)

NNPP and infrastructure construction under the project will require a wide range of construction activities that will, however, affect the different parts of the assessed area with different intensities. The highest impact will be that of construction in sub-area no. 2, where subpopulations of all amphibian species and most reptile species found could be destroyed. The loss is irreversible. In the other sub-areas, no. 3 and no. 4, biotopes will mostly be disturbed just temporarily (water line restoration, power output to the Kočín switchyard) or animals will be disturbed by construction work, with a risk of vehicles killing amphibians and reptiles.

Positive impacts (expected improvement - development of populations)

The construction of the NNPP Temelín cannot be expected to have any direct positive impact on the development of amphibian or reptile populations in the area.

Indirect impacts of project implementation on identified taxa and communities

Negative impacts (loss of a biotope, direct intervention in a habitat)

Expected indirect impacts include, in particular, traffic on service roads and construction machinery movements. These can, especially in the spring migration period, result in killing amphibians and reptiles.

Positive impacts (expected improvement - development of populations)

None identified. If depressions created by heavy machinery remain in the waterlogged terrain after the renovation of the water supply line (sub-area no. 3) or the construction of voltage evacuation lines to the Kočín switchyard, this would temporarily improve the conditions for e.g. fire-bellied toads (genus *Bombina spp.*) or the alpine newt (*Triturus alpestris*). These species seek such small depressions, filled with water in spring, for reproduction. As already said, this would be only a temporary situation, lasting for a couple of years, before such depressions are filled with ground or vegetation.

D.I.7.1.2.6. Ornithology

Direct impacts on identified taxa and communities

Negative impacts (loss of a biotope, direct intervention in a habitat)

As already said above, the area under investigation is rather rich in birds. With their excellent dispersion and migration capabilities, birds are exceptionally adaptable to a number of changes in the landscape unless a biotope is lost completely. The construction of Temelín cooling towers will completely destroy the site of the original cooling tower foundations in sub-area no. 2. However, the capacity of surrounding biotopes is sufficient to absorb all species currently living in the area. As compensatory measures are being prepared for non-migratory and partially migratory groups (molluscs, amphibians, reptiles) in the form of new water pools and wetlands, it is highly probable that such biotopes will also become suitable substitute habitats for birds. It can be expected that the power plant extension will result in the formation of certain successional herb and woody plant communities that will replace the communities lost in the construction.

The construction of the water supply line can only temporarily affect the composition of bird fauna in the investigated sub-area no. 3. It can be expected that natural conditions will be restored shortly after the end of construction work. The construction of the voltage evacuation line to the Kočín switchyard will not have any major impact on biodiversity in the investigated sub-area no. 4. Certain changes may only be seen during the construction period. Its nature (high-voltage line) and affected area (fields with arable land) give a sure guarantee of early re-colonisation of the affected area. Bird communities inhabiting adjacent forests and water bodies will not be affected by the construction, either.

Indirect impacts on identified taxa and communities

Negative impacts (loss of a biotope, direct intervention in a habitat)

No indirect impacts of the NNPP construction are known, besides the above direct impacts on some biotopes at the construction site.

Positive impacts (expected improvement - development of populations)

The NNPP construction site can bring about new nesting possibilities (at a local level) for some species (e.g. wheatear).

D.I.7.1.2.7. Mammaliology

Direct impacts on identified taxa and communities

Negative impacts (loss of a biotope, direct intervention in a habitat)

The construction will result in the destruction of existing biotopes in sub-area no. 2, where the most interesting biotope today is a partially waterlogged and partially aquiferous pattern of small spots at the site of excavation for cooling tower foundations. The humid places are edged by earth repositories, which on the contrary have the nature of rather dry and warm habitats. Neither observation nor trapping proved the occurrence of any interesting or specific animals in this area; therefore, the loss of this biotope is not significant for mammals.

The construction of a high-voltage line to the Kočín switchyard (sub-area no. 4) and the renovation of the water supply line (sub-area no. 3) will not permanently damage biotopes for animals found in this part of the assessed area. There will be intensive disturbance temporarily (during the construction period), which will force especially larger mammals to leave places near the construction. This is only a temporary situation.

Positive impacts (expected improvement - development of populations)

No positives were found.

Indirect impacts of the expected intervention on identified taxa and communities

An indirect impact of the construction that can be identified is the increased rate of construction vehicle traffic on public roads around NPP Temelín. This can result in a temporary increase in the number of accidentally killed mammals on the roads, especially on roads no. II/105 and II/138.

The increase in traffic will be temporary; it can be expected that this impact will not be significant enough to permanently harm mammal populations in the region.

PLANT (UNITS 1+2+3+4)

D.I.7.1.3. Flora (power plant)

Performed botanical surveys do not indicate that the existing NPP Temelín operation should affect vegetation in any way or cause any changes in the structure of plant communities.

When assessing the indirect and direct impacts of NPP Temelín operation and including the expected future impacts of the NNPP Temelín on plants and ecosystems, consideration was given to the following potential impacts that could cause changes in the range of plant species and composition of plant communities:

- changes in climate around the NPP and NNPP Temelín (in connection with the operation of NPP and NNPP Temelín),
- pollutant load.

Climate changes

Among climate factors whose changes caused by the operation of NPP and NNPP Temelín could possibly affect vegetation, these characteristics are the most important:

- change in air temperature around the cooling towers due to the transfer of heat from the cooling circuit to the surroundings,
- change in air humidity due to water evaporated from the cooling towers,
- shading by the plume of vapour from the cooling towers.

Generally, all these factors can act in isolation but in practice they always act in synergy. An increased temperature on its own will probably raise the share of thermophilic species, especially continental species in our conditions, but the simultaneously increased humidity (and possible shading) can eliminate that effect completely; or, on the contrary, at a higher temperature but simultaneously increased humidity, thermophilic species can give way to more cryophilic species of a more oceanic (humid) climate. Moreover, the situation is complicated by the fact that neither average annual values nor the values of climate factors in the non-growing season are decisive. Changes in vegetation characteristics are determined primarily by the ratio of temperature to humidity (air humidity as well as precipitation) during the growing season.

The assessment of the impact on climate shows that changes in temperature, humidity and shading resulting from the operation of NPP Temelín and the NNPP are very small and, if they are measurable at all, they only affect the immediate surroundings of the cooling towers and the NPP Temelín site. No plant species or plant communities that would be at the border of their distribution in terms of climate characteristics were found in the area; therefore, possible small climate changes at the limit of measurability cannot change the population characteristics of individual species and, consequently, the structure of plant communities.

Only secondary plant communities, artificially created and maintained by regular mowing, were documented at the NPP Temelín site itself (sub-area no. 1), where the above factors may fluctuate most. This is an advantage in the effort to comply with the requirement of preserving the existing structure of communities in this area - any potential effect of microclimate changes on this area, which is the most subjected to the potential source of heat and humidity, can be compensated by changing the date of mowing according to the vegetation development stage (phenophase) in a given year. Nevertheless, natural year-to-year fluctuation in climatologic values is in the order of whole grades (for temperature), tens to hundreds of millimetres of water (for precipitation) and kilograms of water per cubic metre of air (for humidity), causing phenophase shifts ranging from days to tens of days. The modelled potential changes in climate factors are lower than the standard fluctuations by one to two orders of magnitude and the caused plant phenophase shift can then range from hours to tens of hours in comparison with the normal situation.

Detailed flora surveys performed in the area in question did not document the presence of any plant species that would be highly dependent on a specific climate factor (temperature, humidity, irradiance). Considering the characteristics of the rather climate-independent flora and the modelled minimum climate changes around the NNPP Temelín, we cannot expect any changes in the vegetation cover in connection with NNPP operation. The effect of the existing NPP Temelín, in combination with the NNPP, on climate is not significant enough to cause measurable changes in the functions and structure of plant communities or even extinction of any of the found plant species, not even in the immediate NNPP Temelín surroundings.

Pollutant load

Air pollution impacts on vegetation have various manifestations; domestic studies have so far been concerned mainly with pollution by acid particles, especially SO_x pollution and pollution by substances containing nitrogen (NH_3, NO_x). According to dispersion analysis, no sulphur oxides will be released in emissions from equipment related to the NNPP Temelín; therefore, they will not be discussed below in relation to biota.

Higher pollution by substances containing nitrogen increases the trophism (productivity) of ecosystems and can manifest itself mainly in communities typical for nitrogen-poor soils (oligotrophic communities with a limiting content of nitrogen). Such oligotrophic communities sensitive to nitrogen pollution include e.g. raised bogs, alpine meadows, non-forest communities in rocks and screes or communities on sandstone or limestone. None of those types of communities were found near the NNPP Temelín and virtually none of the plants found there are among highly nitrophobous species.

While the found plants do include species dependent on habitats poorer in nitrogen, their tolerance to higher nitrogen substance inputs is much higher than that of typically nitrophobous species. Only considerably high NO_x or NH_3 pollution could cause their decline.

The issue of pollution and dispersion analysis, which are the main input for the assessment of the impact of the NNPP Temelín construction on ecosystems, are dealt with in Janatová et al (2009). CO, NO_2 and PM_{10} pollution models included emissions from auxiliary gensets and ammonia emissions from the cooling towers. Concentration contributions from the gensets to annual pollution averages are insignificant and cannot result in exceeding the annual pollution limits even if superposed on (added to) the existing CO, NO_2 and PM_{10} concentration (background concentration, i.e. such that the source in question does not contribute to) in the area under investigation. Similarly, the maximum possible 8-hour highest daily concentrations of CO and maximum possible hourly concentrations of NO_2, when added up with background values, will be below pollution limits.

For suspended particulates PM_{10}, the resulting concentration value may get near the pollution limit. However, when interpreting the maximum possible daily PM_{10} concentrations, consideration must be given to the fact that they are the highest possible values that occur under the least favourable combination of dispersion conditions, some of which may in practice occur with a very low probability in the area in question. Moreover, it must be taken into account that this worst combination of dispersion conditions would have to be present for an entire day.

Therefore, the determined low values of these types of pollution do not represent any impact that could manifest itself in the composition of vegetation species or the structure of plant communities.

The contribution of NH_3 emissions from cooling towers to ammonia concentration in the air in the entire area of calculation does not exceed the order of single nanograms per cubic metre. The NNPP contribution to its surroundings is in the order of tenths of nanograms per cubic metre and the sums of the maximum NH_3 concentrations in the NPP Temelín surroundings, including natural background values and the contribution from NPP and NNPP Temelín, are no more than tens of nanograms per cubic metre.

Maps of the extended area of calculation, including a part of Austria, indicate that the contribution from emissions from NPP Temelín to the total concentration of ammonia in the air rises in the higher areas of the Bohemian Forest, which are closer to the centre line of the dispersing plume than lowland areas. Not even in model cases with the highest concentrations do the maximum NNPP Temelín contributions exceed 1.5 nanograms per cubic metre. The maximum hourly NH_3 pollution concentrations, including the NNPP Temelín contribution, range between 200 and 350 nanograms per cubic metre in the highest areas of the Bohemian Forest and between 5 and 40 nanograms per cubic metre in the NPP Temelín surroundings. In comparison with an already abandoned pollution limit for human health, which was set to 100 $\mu g.m^{-3}$ in the daily average, the maximum concentration values (with the contribution of NNPP Temelín) are at a level approximately 10,000 times lower than the abandoned limit in the NPP Temelín surroundings and still approximately 1,000 times lower in the area of Bohemian Forest ridges. The contribution from the NNPP Temelín source to the total volume of NH_3 contents in the atmosphere represents about 1% for the NPP Temelín surroundings and 0.5% for the ridge areas of the Bohemian Forest. These are minimum shares and with such low total concentrations and contributions to the total volume of NH_3 in the atmosphere, no documentable impact on vegetation can be expected.

Risk of an invasion of undesirable species

This is not a risk specifically associated with the NNPP Temelín construction; rather, it is a common phenomenon that keeps graduating throughout the Czech Republic and Europe due to a growing number of alien species that are introduced to Central Europe and whose significance grows with each disturbance to near-natural and anthropic ecosystems.

In the NPP Temelín surroundings, an invasion of undesirable species is not only an imminent threat but, like in the remaining area in the wider vicinity of Temelín (without any contribution from the impacts of the current NPP Temelín existence), is already underway. The seriousness of this phenomenon for the area around NPP Temelín is rather high, especially because of the surrounding landscape where most of such species are still rare or non-existent. Specifically, the NPP Temelín area is at risk of an invasion of the following species in particular:

- New York aster (*Aster novi-belgii*),
- large-leaved lupine (*Lupinus polyphyllus*),
- Japanese knotweed (*Reynoutria japonica*),
- giant knotweed (*Reynoutria sachalinensis*),
- black locust (*Robinia pseudacacia*),
- Canada golden-rod (*Solidago canadensis*).

If any of these species appear anywhere at the NPP Temelín site or the planned construction, we recommend taking action against them, especially against the knotweed, using standard neophyte control methods (usually a combination of mowing and herbicide application). Most non-native species (including many invasive species other than those listed above) spread mainly on soils rich in organic nutrients. Groundwork, which results in the creation of open areas of non-productive loams and clays, does not on its own help such species spread. However, spreading may occur when the productivity (trophism) of such areas increase, especially after possible reclaiming if it uses topsoil removed from other sites, often rich in nutrients or even enriched with seeds of invasive species from repositories. Therefore, we do not recommend large-scale reclamation using soils imported from other locations, especially after the completion of construction and ground work.

Conclusion

A large botanical survey, performed in the surroundings of the planned NNPP Temelín and on sites where other related construction activities should be carried out, proved that it is a floristically poor area, without any specially protected plant species and with a few species from the Red List of Endangered Plant Species of the Czech Republic. Due to its traditional economic exploitation, the area also lacks natural and near-natural communities.

The construction will result in a decrease in the surface area or destruction of smaller areas covered by vegetation but in no case will it result in a loss of species and communities that do not occur in the surrounding landscape of nearby region. Risks associated with the development of invasive plant species can be reduced to a minimum by adequate treatment of the construction sites and traffic areas after the completion of construction.

The impact of NNPP and NPP Temelín operation (climate impacts and pollution impact) on plants is negligible and will not be measurable or otherwise precisely determinable within standard climate fluctuations and the pollution background. It is not possible to expect any irreversible changes to (extinction of) plant species or plant communities in the region. Therefore, it is not necessary to take any special compensatory measures; it will be sufficient to take measures alleviating construction impacts, consisting mainly in adequate management of areas mechanically disturbed by the construction and their subsequent protection against the penetration of invasive species.

D.I.7.1.4. Fauna (power plant)

D.I.7.1.4.1. Hydrobiology

Prognoses of the impact of Temelín NPP and NNPP operation on water quality are presented below, in the chapter on Ichthyology.

Conclusions of studies performed and knowledge extracted from available literature warrant the assumption that the impacts of the future operation of the Temelín NPP on aquatic invertebrates will probably not be significant. This conclusion applies, in particular, to any changes in the flow rate and water temperature at the site of NPP Temelín wastewater discharge into the river.

However, this prognosis is burdened with some uncertainty due to the variability of future climate change scenarios. Annual fluctuation in temperature - a greater impact is expected in winter, when it might affect the life cycles of invertebrates to some degree, although the forecasted temperature increases are probably insignificant (0.6°C in winter and 0.2°C in summer). Changes in the temperature regime downstream of reservoirs discharging tail water have an impact on benthic fauna. The reduction in species diversity probably has several causes. A water temperature higher than the normal winter temperature eliminates the thermal stimulus that most species need to terminate egg diapause. The discharge of relatively warm water endangers species that require low temperatures (about 0°C) to terminate the pause in egg or larval development. In other species we can observe an acceleration in growth and development, which results in a premature emergence of imagines. Prematurely emerged adults are negatively affected by the low air temperature, which can be even lethal for them. Lower summer temperatures may also have an adverse impact as they reduce the number of daily stages for development completion and the life cycle becomes unsynchronised. Although the mechanisms through which a change in the temperature regime affects invertebrates are not completely known in detail, it is obvious that the overall impact is indisputable. Higher winter temperatures are associated, among other things, with increased productivity, accelerated microbial processes and growing activity of organisms. There is an indirect proportion between productivity and species diversity, which can explain possible decrease in species diversity in an affected watercourse to some degree.

However, the forecasted decrease in the Vltava flow rate (due to water withdrawal or due to potential climate changes) will result in additional phenomena. These include especially a decrease in current velocity connected with a higher sedimentation of suspended substances. This phenomenon can be notable because the water flow already decreases in the area of interest due to damming at the Orlík and Hněvkovice reservoirs. An increased sedimentation brings about the potential risk of a change in the composition of the bottom substrate and a subsequent change in the community of benthic invertebrates. The above-mentioned increase in water temperature may change rapidly, in summer, due to the increased warming of water at a decreased flow rate. Lower flow rates are, once again, an analogy of “minimum” flow rates, when we can observe certain changes in the watercourse caused by a decrease in the volume of water. A decrease in flow rate results in a decrease in water head and velocity, which cause a longer retention period and higher water warming, decreased aeration, increased sedimentation including the sedimentation of fine particles and subsequent changes in the river biota (Zelinka & Kubíček 1985). When the low column of water is sunlit, the water temperature rises considerably and may exceed the forecasted values and eliminate sensitive species.

However, it is very difficult to model the above situation at the moment; therefore, we recommend to start monitoring the current velocity, water temperature and sedimentation of suspended particles as soon as the NNPP is put into operation.

Assessment of the radiotoxic impacts of tritium and other radionuclides on aquatic organisms

Radioactive sources in the environment are natural and artificial. Naturally produced tritium is categorised as a cosmogenic radionuclide. Artificial sources mean tritium that is introduced into the environment by human activities. These include waste discharges from nuclear power plants and tritium leaks into the environment during accidents at nuclear plants, as well as environmental contamination by a large amount of tritium during nuclear tests in 1945-1962 and during the use of nuclear weapons during the Second World War.

Tritium (H-3) in the form of tritiated water is the dominant radionuclide in NPP Temelín waste, which currently operates two units with VVER 1000 pressurised water reactors. For comparison, the ratio of volume activities of radionuclides in liquid discharges from NPP Temelín is H-3:Cs-137:Sr-90, namely 10^9

to 10^{12}:10^5 to 10^6:1. Tritium emits very soft beta radiation of about 18 keV and its physical half-life is about 12.4 years. Tritium occurs in the environment in the form of tritiated water and is part of the normal hydrological cycle. However, tritium in the water form has a relatively low toxicity in comparison with other emitters.

Tritium is practically insoluble in body fluids, so the balance between its ventilation and residual volumes is highly constant. When tritium gets into an aquatic environment, tissue water in all invertebrates and most vertebrates that live there achieves balance with the tritium in water in several weeks. Planktic unicellular algae achieve balance with tritium in water in a couple of days.

NPP Temelín wastewater is discharged into the Vltava in Kořensko. Regular monitoring of tritium volume activities in the Orlík reservoir and in the Vltava downstream, performed by the T.G.M. WRI, has never found volume activities of this radionuclide exceeding the limit pursuant to law and government decrees applicable in the Czech Republic. The maximum measured tritium volume activity of 26.6 $Bq.l^{-1}$ in February 2004 reached 0.65% of the pollution limit for permissible surface water pollution. It has not been possible to demonstrate any relation between tritium volume activities and daily water flow rates. This is caused by the effect of operations at the Vltava reservoirs on the route of tritium discharge from NPP Temelín to Prague - Podolí. The results showed that tritium volume activities measured in the Vltava at Prague - Podolí correspond with NPP Temelín's data on tritium volume activities discharged with wastewater.

The required limit volume activity of tritium in surface water contaminated by waste from NPP Temelín, i.e. 3,500 $Bq.l^{-1}$ pursuant to Government Decree no. 61/2003 Coll., as amended, is fully satisfactory in terms of the radionuclide's possible impact on aquatic biocenoses.

Tritiated precursors of deoxyribonucleic acid are often used in today's biology. Such precursors are incorporated into cells in the DNA synthesis stage immediately before cell division. Since they are incorporated into a genetic substrate, the absorbed dose is very serious. Information about such experiments can make the public get a completely misconceived notion about the genotoxicity of tritium in surface water affected by waste from nuclear power installations.

Tritium is virtually non-accumulable in the aquatic organisms living the Orlík reservoir, which is the most affected by waste from NPP Temelín. The most toxic radionuclides to which attention should be paid are strontium-90 and caesium-137, which are significantly accumulable in aquatic organisms. Because of the accumulation, aquatic biocenoses are a suitable bioindicator of the radioactive pollution of surface water.

Among artificial radionuclides that contaminated our surface water as a result of the Chernobyl nuclear accident in 1986, importance should be attached mainly to caesium-137. It is a radionuclide with a long half-life of 33 years, which accumulated mainly in the muscle of fish. In 1990, the content of caesium-137 found in fish from the Orlík reservoir ranged between 11.5 and 13.8 Bq/kg of fresh weight in predatory fish and between 2.3 and 2.5 Bq/kg in non-predatory species. By 1992, the content of caesium-137 in fish from the Orlík reservoir decreased to about a third. The decrease in fish was caused by their decontamination, desorption and to just a minimum degree by the half-life of the radionuclide. Today, the specific activities of caesium-137 in fish in the Orlík reservoir are less than 0.5 Bq/kg of fresh weight.

Strontium-90, which is highly toxic for aquatic organisms, emits relatively soft beta radiation but its daughter product, yttrium-90, emits very hard beta radiation; the physical half-life of strontium-90 is 30 years. In 1990-1992, the content of strontium-90 in fish from the Orlík reservoir was found to be 1.4-2.0 Bq/kg of fresh weight, probably still as a result of the Chernobyl accident. Today, the specific activities of strontium-90 in the muscles of fish samples from the Orlík reservoir are below the limit of measurability (i.e. less than 0.1 Bq/kg of fresh weight). In algal blooms, plankton and aquatic macrophyta, the specific activities of caesium-137 were below the limit of measurability, 0.1 Bq/kg of fresh weight, already in 1995.

Another radionuclide with a significant share in surface water pollution near nuclear power installations, especially during accidents, is iodine-131. Its physical half-life is 8.1 days. The greater part of iodine-131 that gets into surface water remains in the aqueous phase. Iodine is not a biogenic element. Among hydrobionts, radioiodine is accumulated the most by aquatic plants, in which the maximum accumulation factors are in the order of magnitude of 10^2. The accumulation of radioiodine in the individual constituents of an aquatic ecosystem depends on the content of organic carbon, on the content of the stable carrier of iodine-131 as well as on the season of the year. Fish receive iodine-131 primarily in food. Iodine-131 sorption on sediments is relatively low. Aquatic plants are more sensitive to iodine-131 than fish or aquatic invertebrates. The first adverse impact on aquatic plants can be expected at an iodine-131 volume activity in water of $3.9.10^4$ $Bq.l^{-1}$. An increase in the volume activity of iodine-131 in water results in decreased growth of chlorococcal algae and saprophytic microflora. Iodine-131 was also one of the radionuclides with the highest proportion in atmospheric fallout in the Czech Republic after the Chernobyl accident.

The total content of natural uranium and radium in the Orlík reservoir corresponds to background values in surface water. The content of radium-226 in fish living in the Orlík reservoir ranges between 0.01 and 0.1 Bq/kg of fresh weight; for uranium, the values are in the range of 4-40 µg/kg of fresh weight. Uranium is more toxic for aquatic organisms as chemical poison than as a radioactive emitter.

The limit values of radioactive pollution that can be considered permissible for aquatic organisms will be different in their different living conditions. Comprehensive assessment requires physical measurements as well as biological tests. The advantage of biological tests is the fact that they accumulate both direct and indirect impacts on organisms in the values we get from them. It is not possible to prepare a single and universally applicable manual for biological tests. It is only possible to demonstrate the main guidelines for certain test organisms on suitably chosen models. A comparison of deviations in the response of aquatic population safety protected from radioactive waste, and populations exposed to such an impact, can be an early warning if non-biological indicators suggest that an environment is at a permissible level in terms of radioactive pollution.

An indicator of permissible radioactive pollution is the condition of surface water, when the harmful effect of substances does not result in decreasing the productivity of the water ecosystem, or seriously reducing the range of aquatic species, or exceeding their maximum permissible values of the dose or volume activity of radionuclides. Where wastewater discharges are mixed up with surface water (not less than 90%), suitable biological indicators of a decrease in ecosystem productivity may be the growth curves of algae or the photosynthetic activity of algae (i.e. production per unit of biomass), the reproductive potential of cladocera, the development of fish eggs in the first hours after fertilisation and changes in the species composition of aquatic plants, aquatic invertebrates and fish greater than 5-10%.

For the mixture of radionuclides discharged from NPP Temelín, ecologically undisturbed aquatic biocenoses will be ensured by radiation doses lower than 3.6 Gy/yr. The indicator is specified in variables describing the external and internal exposure of aquatic organisms directly or through their food chains. Compliance with the maximum permissible value of doses is assessed on the basis of the volume activities of radionuclides in water, aquatic organisms and dose rate from the surrounding environment.

In conclusion, we can say that from the radioecological point of view, normal NPP Temelín operation will not results in an adverse impact on aquatic biocenoses in the Orlík reservoir or in the Vltava downstream. It can also be expected that from the radioecological point of view, no adverse impact on aquatic biocenoses in the Orlík reservoir or in the Vltava downstream will occur when the assessed additional NNPP is put into operation alongside the existing NPP Temelín.

Conclusion

The results of performed studies do not indicate any serious increase in the concentration of organic substances (COD_{Cr}) and nutrients in wastewater under normal operating conditions. The reason is the continuous decrease of organic substance concentrations in the Vltava itself as well as the well-designed capacity of the NPP Temelín wastewater treatment plant, which should handle the planned pollution even when the volume of wastewater increases. Since no considerable deterioration of water quality in terms of the input of phosphorus compounds is anticipated either, it can be assumed that there will be no major changes to the concentration of phytoplankton in the Vltava and, consequently, in the Orlík reservoir. However, since the prevailing source of phosphorus compounds in our conditions is generally municipal wastewater and washings from the basin, it cannot be excluded that deterioration of water quality may be caused by sources other than the power plant. Potential increase in the abundance of phytoplankton, or chlorophyll concentration, would result not only in changes in the community of aquatic organisms but also in an increased sedimentation and changes to oxygenation conditions. These issues are considered in Hanslík et al. (2009), where the authors anticipate a decrease in the basin pollution load from planar and diffusion pollution sources in the basin.

As far as the impact of radioactive substances is concerned, an available information and literature search allow deducing that the impacts of radionuclides, regardless of their total volume activity, are usually greater on still water than on flowing water. Therefore, the Orlík reservoir and other places with backwater along the Vltava will have a greater load of sediment radionuclides. Radionuclide loading is lower in rivers because of the constant flow of water and thus faster decontamination, dilution and the replacement of plankton with non-contaminated organisms (Smith et al. 2001; Gudkov et al. 2005). However, in the specific case of the Orlík reservoir, the radioactivity values found are minimal and do not have any documentable impact on the ecosystem. Moreover, the determined activity keeps decreasing and its main source is not the NPP Temelín operation but sources that are not connected with NPP Temelín operation in any way.

As for radiocesium-137, it is possible to expect its adsorption on suspended particles (see Ciffroy et al. 2009). Besides mineral suspended particles, potential surfaces for the adsorption of radionuclides can be found mainly on phytoplankton or zooplankton cells. While an expansion of phytoplankton (and a growth in the measurable biomass in the form of chlorophyll) can be expected in connection with the higher concentrations of phosphorus, the results of the study performed by Hejzlar et al (2009) imply that the impact of phosphorus on the ecosystem in the Vltava and Orlík should be minimal. Since top consumers/predators in water, mainly fish in our conditions, receive radionuclides in food as well as by plain bioconcentration from water, their final contamination will depend also on available food sources. Once again, it can be expected that the ecosystem loading from radionuclide contamination should be lower in freely flowing water than in the still water of the Orlík reservoir. However, a minimum load has been documented for this location, well below the critical values that could cause a load in the food chain, including fish. Moreover, most of the known load originates from sources other than the operation of the Temelín NPP and no significant increase in the load can be expected in connection with the operation of the Temelín NNPP.

D.I.7.1.4.2. Entomology

The operation of the existing NPP Temelín itself does not have any documentable impact on insect populations and communities. The existence of the plant site offers a number of secondary biotopes favourable for insects, especially areas with a depleted vegetation cover, which will be preserved in about the same scope as today.

Other impacts that could affect the composition of communities in connection with power plant operation include in particular:

- climate change around NPP and NNPP Temelín,
- pollutant load.

The scope of potential changes in the climate around NPP and NNPP Temelín was described in a study by Řezáčová et Sokol (2009). Change values in their models are minimal and cannot be assumed to affect the composition of entomofauna. Moreover, most insect species interesting from a conservational point of view that were found in the area during a stock survey belong among rather thermophile species, which means that a possible minimum rise in the temperature would suit such species rather than endanger them. The more important species found on waterlogged and flooded areas in the western part of the site (sub-area no. 2, intended for the construction of cooling towers) will not remain in that location if the project is implemented. The substitute biotopes built in the cadastral area of Všemyslice in 2009 are out of range of any conceivable climatic impact of NPP and NNPP Temelín.

Thanks to good dispersion conditions, the pollutant load in the NPP Temelín surroundings is low and the NNPP's contribution to current ammonia pollution concentrations will be in the order of about 1%. With the concentrations of this substance, which will be in the order of tens of nanograms per cubic metre of air including the impact of the NNPP, no demonstrable impact on entomofauna can be assumed.

Risk of an invasion of undesirable species

Naturally, the territory of the Czech Republic hosts a number of non-native insect species, some of which spread spontaneously and invasively across large areas. For example, there has recently been extensive coverage of the spreading Asian ladybird *Harmonia axyridis*, which was also found in many places in the South Bohemia region. Nevertheless, the spreading of most invasive species is more likely related to the growing of agricultural or garden products or stock storage. It cannot be expected that any invasive insect species will spread to the area in direct connection with project implementation.

Conclusion

An entomological survey evaluated specific areas near NPP Temelín and identified habitats with documentable occurrence of specially protected and endangered insect species. It pinpointed areas that can be considered conflicting with nature conservation in relation to construction execution, at least as far as the potential destruction of habitats of specially protected and endangered insect species is concerned.

The most problematic area was found to be the former construction site where foundations for cooling towers for the planned third and fourth units of the NPP had been excavated in the 1980s but the cooling towers were never built. Rainwater collects in the created terrain depression and has gradually given rise to a secondary wetland with relatively high species diversity.

The area is still intended for the construction of cooling towers and is included in the planned NNPP construction project. The biotope will be destroyed by the construction but adequate substitute habitats will be created beforehand in sufficient time before the destruction.

Other areas where specially protected and endangered species occur (especially earth repositories and ruderal areas) will not be destroyed on a large scale and while they host rarer animal species, they are principally not irreplaceable and the loss will be temporary and reversible.

The other evaluated areas (reclaimed fields, crops) are of rather negligible conservational importance from an entomologist’s point of view and the implementation of the project will probably not result in any serious and irreversible damage to this ecosystem constituent.

The construction of a new power output line should not present a high risk for entomofauna. The construction will be located in already highly altered habitats, which cannot be considered unique in the surrounding context. Specially protected species occurring there have enough suitable biotopes in the close vicinity and the construction will disturb the biotope only temporarily and reversibly.

The renovation project for the cooling water supply line from the Hněvkovice reservoir may have a temporary negative impact on grassland near Litoradlice and the petrol station “U Bočků”, depending on the specific location and execution of construction. Since the system to be renovated is about 20 years old, it can be assumed that the biotopes can be restored to their original condition once this part of the construction project is finished. Insects will easily re-colonise the areas from the surrounding biotopes, which will not be affected.

D.I.7.1.4.3. Malacology

The operation of the existing NPP Temelín itself does not have any documentable impact on mollusc populations and communities. Impacts possibly associated with the power plant operation can be seen in:

- climate change around NPP and NNPP Temelín,
- pollutant load.

Climate change values are minimal and do not represent any significant impact on the composition of mollusc communities. None of the species found has a distinctive temperature preference (distinctly thermophilic or cryophilic). Therefore, it cannot be assumed that a very small change in temperature, humidity and light exposure, as stated in the models, could change the existing conditions and cause mollusc extinction or, on the contrary, invasion.

Thanks to good dispersion conditions, the pollutant load in the NPP Temelín surroundings is low and the NNPP’s contribution to current ammonia pollution concentrations will be in the order of about 1%. With the concentrations of this substance, which will be in the order of tens of nanograms per cubic metre of air including the impact of the NNPP, no demonstrable impact on malacofauna can be assumed.

Risk of an invasion of undesirable species

The survey verified the occurrence of 2 introduced North American species (*Physella acuta, Gyraulus parvus*), which are found relatively commonly in the Czech Republic today. Since no new biotopes for the two invasive species will be created in the area after the completion of construction, there is no reason to assume that the construction project could help spread geographically non-native species of molluscs.

Conclusion

The construction under consideration (meaning the construction work and the building itself, not its operation) will have a negative impact (complete destruction) on a single important habitat located inside the NPP Temelín site. The biotope is virtually the only important one among those potentially affected; it is rich in species even though no specially protected mollusc species are found there. The interventions in other locations during the construction, the high-voltage evacuation and upgrade of the water supply line, can be considered less significant and can be eliminated by minor compensatory measures. On the contrary, the interventions can even result in an improvement of the habitats. If the construction is executed, we find it necessary to appoint an environmental supervisor, a professionally qualified person that will make sure the biota in the environment in question is not unnecessarily damaged.

D.I.7.1.4.4. Ichthyology

Change in water quality

Three basic types of water will be discharged from the site in connection with the NNPP and existing NPP Temelín operation: rainwater, sewage and process water.

As for the discharge of rainwater, its volume will increase due to an increased ratio of paved surfaces to unpaved surfaces. However, the volume of discharge will not be greater than the value originally specified for the previously planned 4x1000 MW_e plant site. In terms of effect on quality, the situation will remain the same as today. During normal operation, the quality of water in Strouha Brook, into which rainwater is drained, will not affected. This also applies to the Vltava itself, into which the Strouha discharges (in the Hněvkovice reservoir). An accident involving petroleum product leakage will be handled using equipment for petroleum product collection and removal, which is already installed at the Býšov safety reservoirs. Based on the above facts, the impact of an increase in the volume of discharged rainwater on fish stock in the Vltava is assessed as insignificant.

Sewage will be drained by a separate sewerage system to a wastewater treatment plant. The existing WWTP is expected to be renovated and used for both the existing NPP Temelín, and the NNPP. The amount of sewage is relatively low in relation to water flow rates in the Vltava (high dilution of residual pollution). Therefore, if the efficiency of treatment at the WWTP is preserved (or improved), the increase in the volume of sewage will not result in any deterioration in water quality (saprobiological indicators) in the Vltava and thus will not affect the structure of fish stock.

The biggest potential impact can be expected for the discharge of process waste water from the NNPP. Since it will effectively be an extension of the existing plant, it will not change the structure of pollutants in process water but rather their amounts. The impact of the individual NNPP variants and the simultaneous operation of the NNPP and existing NPP Temelín on the quality of water in the Vltava downstream of the wastewater discharge is predicted in a study by Hanslík et al (2009). Its results disclose the crucial fact that the increment in the concentration of all non-radioactive substance indicators is relatively small and ranges from tenths of a percent to a few percent. This applies to all NNPP variants under consideration (using different types of reactors and various climate scenarios). As for the BOD_5, N - NH_4 and non-ionic surfactant parameters, the concentration of the substances in the watercourse will slightly decrease. Other indicators will increase by tenths of a percent to a few percent. The highest percentage increase will be in the SO_4, N - NO_3, N inorg., P - PO_4 and DIS parameters, up to about 10% (differently for the various technology variants and climate scenarios).

In terms of the impact on the fish community, the predicted values of Vltava water indicators after the commissioning of the NNPP can be compared with two fundamental documents - Czech standard ČSN 75 7221 (Water quality - Classification of surface water quality) and Government Decree no. 71/2003 Coll. ("Fishing Waters"). In respect to ČSN 75 7221, achieved indicator values will put water in the Vltava mostly in Category I (unpolluted water) or Category II (slightly polluted water). Only with COD_{Cr} a minor concentration increase to more than 25 mg/l (by about 1-2%) will result in a shift from cleanliness class II to cleanliness class III (polluted water). With respect to Government Decree no. 71/2003 Coll., whose Annexe 2 includes a list of indicators and quality values, all three indicator values defined for carp fishing waters will be complied with.

In summary, changes in the concentrations of non-radioactive substance indicators caused by NNPP operation will not be significant enough to result in any major changes to the species composition of the fish community in the Vltava downstream of the discharge of wastewater from the NNPP and existing NPP Temelín. In the future, the ichthyocenosis will remain affected primarily by the historical change in the river hydrology (construction of the Vltava cascade of dams) and fish management in the reservoirs.

Change in water temperature

Another impact of physicochemical nature taken into consideration in relation to NNPP operation is an increase in the temperature of water in the Vltava, which will be caused by the discharge of warmed waste (treated) water. The values of the anticipated increase in water temperature were also taken from Hanslík et al (2009). The increase in water temperature will be very small for all technology variants and all climate change variants under investigation. Calculated temperatures at the level of 2020 range from 11.43-11.47°C, which means an increase of just 0.13-0.17°C. Differences between the individual climate scenarios amount to hundredths of °C. Such an insignificant increase in average temperatures cannot result in a relevant shift in the structure and species representation of the fish community in the Orlík reservoir (or in the entire Vltava watercourse). Pursuant to Government Decree no. 71/2003 Coll., the permissible increase in water temperature in carp waters at the end of a mixing zone is up to 3°C against the unaffected value and in absolute values the temperature may not rise above 28°C. These legal requirements will be met without any difficulties.

A significant group of water pollutants related to NNPP operation will be radioactive substances. To assess their impact on the fish community, we once again used calculations and predictions from Hanslík et al (2009). The background of radioactive substances from 2020 onwards was estimated at 0.8 Bq.l^{-1} for tritium and at 0.0005 Bq.l^{-1} for other AAFP (expressed as caesium-137). The forecast volume activities of tritium at the level of 2020 range from 70 to 157 Bq.l^{-1}, including the background. A similar range of values was calculated for the NNPP and NPP Temelín at the level of 2025, namely 64-143 Bq.l^{-1}, including the background. For water flow rates in the Vltava at Kořensko at the level of 2085, the range of tritium volume activities for the NNPP and NPP Temelín was forecast to be 100-201 Bq.l^{-1}. The forecast levels of tritium volume activities are significantly lower than the derived pollution limit of 700 Bq.l^{-1}. All of the above values are in cleanliness category II (slightly polluted water) as per ČSN 75 7221. As for other AAFP, the individual NNPP variants in combination with the existing NPP result in volume activities expressed in caesium-137 in the range of 0.012-0.017 Bq.l^{-1}, including the background, at the level of 2020. At the level of 2025, the volume activities range from 0.012 to 0.016 Bq.l^{-1}; at the level of 2085, the volume activities of other AAFP downstream of the discharge of NNPP and NPP Temelín wastewater would be 0.011 to 0.022 Bq.l^{-1}. Differences in AAFP increments are very small between the individual NNPP power output alternatives. The forecast levels of the volume activities of other AAFP (caesium-137) are significantly lower than the derived pollution limit of 0.1 Bq.l^{-1}.

The genotoxic impact of radionuclides on aquatic organisms is analysed in a separate chapter in Hanslík et al (2009). Tritium in the water form has a relatively low toxicity in comparison with other emitters occurring in the NPP Temelín waste. If tritium gets into an aquatic environment, tissue water in all invertebrates and most vertebrates that live there achieves balance with the tritium in water in several weeks. Tritium is virtually non-accumulable in aquatic organisms, including those living in the Orlík reservoir, which is the most affected by NPP Temelín waste. The conclusion drawn from data in literature is that safety limits for tritium in surface water downstream of nuclear power plants should be lower than 10 kBq.l^{-1} because of the aquatic biosphere (including fish). The same value is cited in Hanel et Lusk (2005). The forecast maximum values after NNPP commissioning, about 200 Bq.l^{-1}, are thus well below the above safety limit. The required limit volume activity of tritium in surface water contaminated by NPP Temelín waste at the level of 3,500 Bq.l^{-1} pursuant to Government Decree no. 61/2003 Coll., as amended, is fully satisfactory in terms of the radionuclide's possible impact on aquatic organisms including fish.

Change in river flow rate due to water withdrawals

To maintain the correct function of a river ecosystem, it is necessary to maintain a sufficient water flow rate in a bypassed (deprived of water) watercourse section. This is the minimum residual flow rate (MRFR), which is derived from the biological flow rate. Long-term surveys of our watercourses have found that maintaining biological flow rates ensures that aquatic communities in watercourses and the aquatic ecosystem as a whole will not be significantly negatively affected by decreased water volumes (Lellák et Kubíček 1992). The flow rate value is specified so that it prevents negative changes in the original communities of aquatic organisms.

The hydrological conditions in the Vltava are profoundly affected by the presence of a cascade of water reservoirs (dams), which change the original morphological characteristics as well as the flow regime of the river. These facts have to be taken into consideration when defining the MRFR value for the Vltava. Thanks to the damming-up and the possibility to increase low flow rates using the retention volume of the reservoirs, critically low flow conditions and physical lack of water, manifested by low water depth and a drying up riverbed, virtually never occur in the Vltava. This applies to the river section from the dam of the Orlík reservoir to the backwater end of the Kořensko reservoir (upstream from Týn nad Vltavou). The same conditions are in the section of the Vltava upstream of the dam of the Hněvkovice reservoir. The increased water withdrawal associated with NNPP operation, estimated at 2.4 to 3.4 $m^3.s^{-1}$ (maximum values) depending on the variant built, should be covered by the Hněvkovice reservoir. Since the volume of water in the reservoir can be adjusted, the water volume (and depth) will not be dropped to a level that could in the long run negatively affect the composition of the fish community, which is of a secondary nature there.

Virtually the only section of the Vltava with relatively preserved river parameters (flowing water, rapids) and the original fish fauna is preserved between the above-mentioned sections, i.e. from the backwater end of the Kořensko reservoir to the dam of the Hněvkovice reservoir. This section is about 3.5 km long. This section of the river is not affected by backwater ("potamalisation") from any reservoir; however, flow dynamics in the river are affected by operations at the Hněvkovice reservoir. Since this reservoir is used for withdrawing water needed by NPP Temelín (and the NNPP in the future), the required MRFR value must be maintained in the bypassed river section. The primary document for determining MRFRs in watercourses is the Methodological Guideline issued by the Department of Protection of Waters, Ministry of the Environment, in October 1998. According to the guideline, guide values of MRFR are derived from the water flow rate value in a watercourse at the level of Q_{355d}. Generally, the lower the value of Q_{355d} for a given year, the higher the MRFR value that should be maintained in the watercourse. The value of Q_{355d} for the given point in the Vltava is 6.44 $m^3.s^{-1}$. According to methodology in the above-mentioned guideline, the guide value of MRFR should be at least $(Q_{355d}+Q_{364d})x0.5$, i.e. (6.44+4.29)x0.5 = 5.37 $m^3.s^{-1}$.

Maintaining this MRFR value downstream of the Hněvkovice reservoir dam after the commissioning of the NNPP will preserve favourable environmental conditions for the Vltava section unaffected by backwater and its ichthyofauna.

D.I.7.1.4.5. Herpetology

The actual operation of NPP Temelín and the NNPP, after completion, will not have any negative impact on this group. Identified changes in microclimate are minimal. The reduced time of sun exposure due to shading by the plume of vapour from cooling towers does not have any impact. If the NPP Temelín vapour plume had such an impact, there would not have been such a quick development of populations of a number of species in sub-area no. 2. After the extension, none of the described amphibian and reptile biotopes will be close enough to be affected by a measurable impact. The proposed compensatory measures for amphibian and reptile translocation are located so far away that the impact of a slightly shifted climate is undetectable.

Risk of an invasion of undesirable species

There is currently no invasive amphibian species in the Czech Republic. As for reptiles, there is a geographically non-native but as yet not breeding species: the red-eared slider *Trachemys scripta*. Its spreading in connection with the project is impossible.

Conclusion

Amphibians and reptiles are definitely the group of animals that will be the most affected by the planned NPP Temelín construction. In particular, a whole habitat will be destroyed in sub-area no. 2; this habitat is totally unique and important in terms of the species found there as well as the numbers of specimens. It should be noted, however, that if the habitat were "conserved for protection", it would undergo spontaneous biological degradation in a few years and then disappear. The site is very quickly overgrown by self-sowing woody plants. If the planned construction is executed, it will be absolutely necessary to arrange, in good time beforehand, translocations of all amphibian and reptile specimens to substitute habitats. Some of them (for amphibians) have already been built near Bohunice. 15 pools of various sizes have been built at three locations. As for the other sub-areas, the construction may disturb or damage habitats inhabited by specially protected animals but without any serious impact on such organisms.

D.I.7.1.4.6. Ornithology

The expected minor local climate changes and pollution conditions around the NNPP are not such that they could affect bird populations.

In terms of the large-scale impact of power generation on birds, it should be noted that power generation at a single central source with a high power output is much less stressful for birds than a large number of small sources, especially the more and more common wind turbines. Their share in disturbing and killing birds is much higher than that of a solid building.

Risk of an invasion of undesirable species

Within the category of birds, the site is not at risk of an invasion of undesirable species.

Conclusion

Project implementation will not permanently decrease the biodiversity of birds in the area in question (power output will only add to the existing number of power lines; the water supply line will not be visible when finished and it will take a short time before all evidence of its construction disappears). It may only restrict it during the construction period. No bird species will disappear from the area in question due to the construction. On the contrary, the NNPP construction site can bring about new nesting possibilities for many species (e.g. wheatear). The only habitat that will be destroyed permanently is the aquiferous terrain depression in sub-area no. 2.

D.I.7.1.4.7. Mammaliology

Species that make up the mammal community in the region around NPP Temelín and the planned NNPP Temelín construction are common and widespread European species. Therefore it cannot be assumed that the small climate changes (associated mainly with the shorter sunlight period due to the vapour plume of NNP and NNPP Temelin cooling towers) could affect the population density or spatial distribution of individual mammal species. The operation of the water supply line and the newly planned voltage evacuation lines to the Kočín switchyard have no impact on the mammals in the area. Likewise, no impact can be assumed on aquatic mammals dependent on the Vltava (the European otter *Lutra lutra* can be expected to occur there). The European otter represents a top predator in the food chain; however, it has already been said in the chapters concerning hydrobiology and ichthyology that those ecosystems will not be significantly affected, and thus no significant impact on this species can be expected either.

Risk of an invasion of undesirable species

A number of geographically non-native and some invasive mammal species occur in the Czech Republic today. The most troublesome species of the recent years are in particular the American mink, nutria and North American raccoon; in the near future, we will very probably experience an invasion of the Eastern Grey squirrel.

The NNPP Temelín construction project does not have any consequences for the ongoing or potential invasions of any of the above-mentioned or other invasive mammal species known in the Czech Republic. On this account, it is not necessary to take any measures for protection against invasive species.

Conclusion

No part of the planned construction of the NNPP and the necessary infrastructure will permanently affect mammal species in the area in question. A range of species in the vicinity of construction can be temporarily disturbed by construction work but this is a completely reversible change.

D.I.7.1.5. Summary and conclusion of the fauna, flora and ecosystems section

D.I.7.1.5.1. Summary data

With its scope, the project under consideration is obviously an extraordinary construction. The volume of data obtained for its environmental impact assessment is extraordinary, too. Nevertheless, it is an extension of an existing construction that already exists at the site in question, and a great deal of infrastructure such as roads and pipelines was built for the original NPP Temelín.

In terms of biological assessment, i.e. the assessment of the project's impact on plant and animal species, including specially protected plant and animal species, its impact on ecosystems, the landscape and specially protected areas, real negative impacts of the construction and operation of the NNPP are minimal in comparison with the scope of investment. Differences between the 2x1200 MW_e and 2x1700 MW_e power alternatives are also minimal; the solution with one cooling tower per unit (for the 2x1200 MW_e power alternative only) then does not result, considering the conclusions cited, in any significant differences.

The biggest positive of the NNPP construction in Temelín is the relatively small area of new land appropriated outside the existing NPP Temelín site and incomparably less land appropriated for the construction and necessary infrastructure than would be necessary for a completely new power source built at a greenfield site.

In addition to the fact that the project under consideration is located at an existing site with built infrastructure, another important factor in the project impact assessment is the fact that the NPP Temelín surroundings host common ecosystems typical for that region, with common plant and animal species, and there are no specially protected area in the vicinity. Consequently, the construction cannot result in an irreversible loss of any natural phenomenon unique and irreplaceable in the region even if recommendations for the mitigation of the construction's impact on nature or good technical practice are not complied with. Likewise, no irreversible damage to flora and fauna around NPP Temelín can be assumed in the event of a maximum design accident inside the NPP Temelín site.

The biological assessment shows that there are no plant and animal populations in the area that would be at risk of extinction at a regional or higher level (national level or even complete extinction of a species). At the local level, the occurrence of some plant and animal species will be reduced and sub-habitats for some populations will be lost, especially in the area intended for the construction of cooling towers.

The impact of the construction and operation of NNPP Temelín on plants and animals, within the groups assessed, can be concisely and with a high level of generalisation summarised into the following table:

Table D.I.128: Impact of NNPP Temelín construction and operation on organisms and ecosystems

	NNPP construction					Operation of NNPP+NPP				
	Sub-area no. 1	Sub-area no. 2	Sub-area no. 3	Sub-area no. 4	Vltava	Sub-area no. 1	Sub-area no. 2	Sub-area no. 3	Sub-area no. 4	Vltava
Plants	3	1	4	4	-	4	4	4	4	-
Hydrobiology	4	4	4	4	4	4	4	3	4	4
Insects	4-5	2	4-5	4-5	-	4	4	4	4	-
Molluscs	4	3	4	4	-	4	4	4	4	-
Fish	4	4	4	4	4	4	4	4	4	4
Amphibians	4	0	3	3	-	4	4	4	4	-
Reptiles	4	0	3	3	-	4	4	4	4	-
Birds	4	2	4	4	-	4	4	4	4	-
Mammals	4	3	4	4	-	4	4	4	4	-
Ecosystems	3	0	3	3	4	2-3	4	3	4	4
Total	38-39	19	37-38	37-38	12	38-39	40	38	40	12
Average	4	2	4	4	4	4	4	3	4	4
Lowest value	3	0	3	3	4	2-3	4	3	4	4

Key for scoring:

0 points = destruction of an entire habitat or part thereof, irreversible
1 point = irreversible damage to a habitat
2 points = significant damage
3 points = partial damage, restoration possible
4 points = insignificant damage, fully reversible, or without any risk of damage whatsoever
5 points = improvement of conditions, desirable impact

D.I.7.1.5.2. List of identified specially protected species of organisms

A list of all identified specially protected species of organisms is included in the table below. Also included is information about the scope of intervention in their biotope by the NNPP Temelín construction and, if a species is endangered by the activity, a proposal is made for an exemption, including the public authority competent to grant the exemption.

Table D.I.129: List of all identified specially protected species of organisms

	SPS category	Species affected, exemption needed	Species highly affected, creating a substitute biotope necessary	Exemption granted by
Butterflies				
Apatura ilia - lesser purple emperor (Bejček 2007)	E	No	No	-
Papilio machaon - Old World swallowtail	E	No	No	-
Bumblebees				
Bombus lapidarius - red-tailed bumblebee	E	Yes	No	Regional Authority
Bombus pascuorum - common carder-bee	E	Yes	No	Regional Authority
Bombus ruderalis - red-shanked carder bee	E	Yes	No	Regional Authority
Bombus terrestris - buff-tailed bumblebee	E	Yes	No	Regional Authority
Bombus bohemicus - gipsy cuckoo-bee (Bejček 2007)	E	Yes	No	Regional Authority
Bombus campestris - field cuckoo-bee (Bejček 2007)	E	Yes	No	Regional Authority
Bombus rupestris - hill cuckoo-bee (Bejček 2007)	E	Yes	No	Regional Authority
Bombus confusus (Bejček 2007)	E	Yes	No	Regional Authority
Bombus humilis - brown-banded carder bee (Bejček 2007)	E	Yes	No	Regional Authority
Bombus lucorum - white-tailed bumblebee (Bejček 2007)	E	Yes	No	Regional Authority
Ants				
Formica rufibarbis - red-barbed ant	E	Yes	No	Regional Authority
Formica fusca	E	Yes	No	Regional Authority
Carabidae				
Carabus scheidleri scheidleri	E	Yes	No	Regional Authority
Cicindela campestris - green tiger beetle	E	Yes	No	Regional Authority
Oxythyrea funesta - white-spotted rose beetle	E	Yes	No	Regional Authority
Amphibians				
Bombina bombina - fire-bellied toad	HE	Yes	Yes	Regional Authority
Bombina variegata - yellow-bellied toad	HE	Yes	Yes	Regional Authority
Bufo bufo - common toad	E	Yes	Yes	Regional Authority
Bufo viridis - European green toad	HE	Yes	Yes	Regional Authority
Hyla arborea - European tree frog	HE	Yes	Yes	Regional Authority
Pelobates fuscus - common spadefoot	HE	Yes	Yes	Regional Authority
Rana esculenta - edible frog	HE	Yes	Yes	Regional Authority
Rana lessonae - pool frog	HE	Yes	Yes	Regional

				Authority
Rana ridibunda - marsh frog	CE	Yes	Yes	Regional Authority
Triturus alpestris - alpine newt	HE	Yes	Yes	Regional Authority
Triturus cristatus - great crested newt	HE	Yes	Yes	Regional Authority
Triturus cristatus - great crested newt	HE	Yes	Yes	Regional Authority
Triturus vulgaris - smooth newt	HE	Yes	Yes	Regional Authority
Reptiles				
Anguis fragilis - slow worm	HE	Yes	Yes	Regional Authority
Coronella austriaca - smooth snake	HE	Yes	Yes	Regional Authority
Anguis fragilis - slow worm	HE	Yes	Yes	Regional Authority
Coronella austriaca - smooth snake	HE	Yes	Yes	Regional Authority
Lacerta agilis - sand lizard	HE	Yes	Yes	Regional Authority
Lacerta vivipara - common lizard	HE	Yes	Yes	Regional Authority
Natrix natrix - grass snake	E	Yes	Yes	Regional Authority
Birds				
Accipiter nisus - Eurasian sparrowhawk	HE	No	No	-
Anas crecca - common teal	E	No	No	-
Anas strepera - gadwall	E	No	No	-
Apus apus - common swift	E	No	No	-
Circus aeruginosus - marsh harrier	E	No	No	-
Hirundo rustica - barn swallow	E	No	No	-
Lanius collurio - red-backed shrike	E	No	No	-
Oriolus oriolus - golden oriole	E	No	No	-
Perdix perdix - grey partridge	E	No	No	-
Podiceps cristatus - great crested grebe	E	No	No	-
Saxicola rubetra - whinchat	E	No	No	-
Tachybaptus ruficollis - little grebe	E	No	No	-
Tyto alba - barn owl	HE	No	No	-
Mammals				
Sciurus vulgaris - Eurasian red squirrel	E	No	No	-
Lutra lutra - European otter	HE	No	No	-

D.I.7.1.5.3. Compensatory measures

Compensatory measures, which are specifically aimed at mitigating the construction impact, are divided as follows:

- compensatory measures before the construction,
- measures during the construction.

Compensatory measures before the construction

Three substitute sites were identified for the translocation of herpetofauna specimens (another site was rejected). All three are near the village of Bohunice. The sites are on the municipal land of Všemyslice, of which Bohunice is an administrative part. Once the approval of the owner (the municipality of Všemyslice) was obtained, the actual implementation of measures started. A substitute habitat was built at each site, which meant either building a new one or rebuilding an old habitat no longer suitable for amphibian breeding.

Substitute site no. 1 — The measure consists in building three small pools below a pond. The first is at GPS coordinates 49°12´20.5“N/014°23´08.2“E, its dimensions are 10x4 m and maximum depth 150 cm; 30 m^3 were excavated. The second is at GPS coordinates 49°12´20.2“N/014°23´08.5“E, with dimensions of 6x4 m and a maximum depth of 130 cm; 15 m^3 were excavated. The third is at GPS coordinates

49°12´21.0“N/014°23´07.8“E, its dimensions are 8x3 m and maximum depth 150 cm; 20 m^3 were excavated. All three are separated from an actual small watercourse running from the pond. Infeed is ensured by seepage from the adjacent small watercourse.

Substitute site no. 2 One more substitute site was initially selected in the cadastral area of Bohunice. After evaluating its hydrological conditions, the construction of substitute habitats at this site was rejected due to possible lack of water.

Substitute site no. 3 The measure consists in constructing three pools of different sizes in a cascade, at GPS coordinates 49°12´44.1“N/014°23´29.0“E. Excavated earth was always used to build a small dam impounding a small water pool. The first pool is located in the lower and largest part of the area; its dimensions are 15x9 m and maximum depth 70 cm; 70 m^3 were excavated. The second, higher one is 8x5 m and its maximum depth is 70 cm; 15 m^3 were excavated. The third pool at the highest location is 4x3 m with a maximum depth of 70 cm, 5 m^3 were excavated.

Substitute site no. 4 The measure consists in creating an entire system of pools at GPS coordinates 49°12´20.1“N / 014°21´45.4“E. A botanical survey was carried out before the actual groundwork to prevent a botanically interesting site from being destroyed by the construction of the pools. The survey documented the occurrence of broad-leaved helleborine *(Epipactis helleborine)*. The construction of the pools then preserved not only the area with the broad-leaved helleborine but also most of rush and sedge vegetation. 9 pools were built instead of the initially planned 8 pools. This was necessary due to the ground slope in the area of pools 1 and 2. If only one pool had been built there as originally planned, its upper part (now pool 1) would have been completely without water. When the proposal for the measure was prepared, the growing season was at its high. At the time of execution, the terrain was much easier to overview, so the execution was adjusted to terrain morphology and final recommendations from the botanical survey. Each pool was built with different dimensions, depth and level of shading. Fully sunlit as well as partially or fully shaded pools were built. The pools are fed by seepage from the surrounding, highly waterlogged ground. A small dam was made from the excavated earth at the upper edge of the pond to prevent the pools from being flooded, and consequently inhabited by fish, at a higher water level. The surroundings of the reservoir offer ample opportunities for animal hibernation. A unique wetland was constructed in the area, suitable as a substitute biotope for the full range of herpetofauna from the original site.

Figure D.I.16: Localisation of substitute sites around Bohunice

Substitute habitats for potential amphibian translocation are thus prepared at three sites now. New habitats were built in all cases and are not inhabited by local amphibian species as yet. Since they are vacant and uninhabited niches, it is only a matter of time before local populations of amphibians find and colonise the places. Therefore, if amphibians (but also reptiles and possibly other animals and plants) should be translocated from the site to be destroyed, it is highly necessary to not waste time and perform the translocation before the substitute habitats created are inhabited by populations in equilibrium with the carrying capacity in the environment (especially food sources and space). If the translocation is not carried out by that time, the substitute sites will be colonised by specimens from the close vicinity and it will no longer be possible to use the sites for translocation from the NPP Temelín site. The substitute biotopes, created in 2009, will be monitored from time to time, especially in the spring amphibian breeding period (March to June) and their potential for possible translocation will be evaluated. If the sites are saturated by natural amphibian populations over time, new areas for the creation of substitute biotopes will be found and translocations will be carried out to such new sites.

As already said, it is important that the execution of compensatory measures should be well timed. All biological studies so far (Bejček 2006a, 2006b, 2007a, 2007b, 2008, Rozínek et Francek 2008a, 2008b, 2009d), individual surveys and preparatory stages for compensatory measures carried out in 2008 and 2009 indicate that the group of amphibians and reptiles will pose the biggest problem during construction. For the planned NPP Temelín construction, this specifically applies to measures that can be divided into several groups:

Building substitute habitats for amphibians. This measure has already been partially implemented. However, a delay may cause a situation (as mentioned above) in which local amphibians spontaneously inhabit the newly created habitats, making them unusable for the planned translocation at all, or usable for just some species, or just partially, or just for a single species. In such case, the entire process of building substitute habitats would have to be repeated. This would mean identifying suitable areas, finding the owners, obtaining their approval of the proposed measure and implementing it. Implementation must be timed well before any planned translocation of amphibians.

Building substitute habitats for reptiles. No compensatory measure has been implemented for reptilians as yet. Stone walls for reptilians will be built at selected sites. Loose masonry is required, individual stones must not be joined with any stabilisation material but only interspersed with earth. The areas will serve as dwelling, refuge, breeding and probably also hibernation sites for reptiles. Their exact locations at a site will be chosen very carefully. Too much sunlight is not advisable; the same applies to excessive levels of shading. Supplementary vegetation will always be planted along the walls, for instance blackberry. The stone walls will be partially embedded in the ground and will be considerably wide and interspersed with earth. Their backs must be merged with the surrounding terrain. These will not be just walls standing on their own and freely accessible from all sides.

Capture of amphibians from the threatened site. If the planned NNPP Temelín is built, after necessary exemptions from Act no. 114/1992 Coll. are granted, it will be necessary to capture all amphibians and reptiles from the most valuable part of sub-area no. 2. Several capture techniques will have to be used due to terrain morphology and different types of biotopes.

Four temporary pitfall fencing systems will be installed at the site. One will be around the entire area of interest. Another will be around all three water bodies. The third one will run through the site to cross the most attractive areas at the site. The fourth will be around the earth repository. The goal of the installation is to capture animals that will successively leave the aquatic environment and young metamorphosed specimens. The goal of the system running through the site is to capture animals moving about the site. About 5,700 m of fencing will be installed in total.

The installation will consist of 60 cm high sheeting attached to anchoring posts made of wood. On the side from which amphibians are expected to pass, the sheeting will be bent in the direction opposite to the passage and earthed up to prevent the animals from crawling under it or digging through. The system will be complemented by pitfall traps with lids. A trap will have small holes in the bottom to allow water drainage and protect animals from drowning. Pitfall traps in wet environments will not have such holes since water would leak into the containers through the holes in the bottom. Each trap will have a lid with a hole to prevent captured animals from crawling out. The fence will be attended daily by an attendant, who will collect captured animals from the pitfall traps. The attendant will also clean the traps and keep the fence impenetrable. They will keep detailed records of captured animals, writing down species, sex and number of specimens.

The best time for installation is before the activity period of the individual amphibian species. The fencing will be installed throughout the amphibians' yearly activity period, i.e. approximately from March until the end of October. Capture will also be carried out at least in the next year, i.e. at least in two successive years. In the next (second, possibly third) year, sexual maturity will be reached by additional amphibians that, being immature, did not migrate to the breeding site at all in the previous year. A fraction of amphibians, especially newts, do not breed regularly every year. This measure will make sure all adult specimens are captured.

The pitfall fence will certainly not capture all specimens. The netting method using hand nets, based on the visual method, and the random catch method will be used to capture adult amphibian specimens still inhabiting the aquatic environment. The visual method with capturing by hand will be used for amphibians already occurring in the terrestrial environment, as well as reptiles. The pitfall trap method will also be used for the two groups. An effective complement will be night time capture in both the aquatic and the terrestrial environments. The capture will be carried out continually throughout the amphibian yearly activity period; there will be the pitfall fence attendant, who will also perform this activity.

The larval stages of amphibians (frog tadpoles and newt larvae) will be captured simultaneously with the capture using temporary pitfall fencing. They will be captured using hand nets. Larvae will then be sorted by species as well as by size to prevent cannibalism. Naturally, tadpoles will be separated from larvae. It will certainly be impossible to capture all larval specimens; therefore, a movable pitfall fence will be installed around the water bodies to capture specimens leaving the aquatic environment. The capture will be carried out continually from June until the end of the metamorphosis of individual species.

Capture of reptiles from the threatened site. The capture of reptiles using a temporary pitfall fence will be carried out in parallel with the capture of amphibians and use the same pitfall traps. Four temporary pitfall fencing systems will be installed at the site. One will be around the entire area of interest. Another will be around all three water bodies. The third one will run through the site to cross the most attractive areas at the site. The fourth will be around the earth repository. The goal of the installation is to capture animals that will successively leave the aquatic environment and young metamorphosed specimens. The goal of the system running through the site is to capture animals moving about the site. About 5,700 m of fencing will be installed in total. See the previous section for a description of the temporary pitfall fencing. The best time of installation for amphibians is early March (depending on climatic conditions) even though reptiles will begin to activate somewhat later.

Translocation of captured amphibians and reptiles. Captured animals (amphibians and reptiles and possibly other small animals) will be transported to substitute habitats on an ongoing basis during the capture period. This is relevant if the capture and subsequent translocation happen relatively early and the built substitute amphibian sites (in the cadastral area of Bohunice) can still be used. Translocation from the place of capture to the substitute habitat will be carried out carefully to prevent injuring or even killing the animals.

Protection of migration routes of amphibians and small animals. Before construction activities are started, it will be necessary to obtain detailed information about the location of the building, construction yards, material repositories, earth repositories and especially material handling routes. These in particular can intersect amphibian migration routes connecting a hibernation site with a breeding site at many places. Immediately before such material handling routes are used or built, the migration routes must be protected by temporary fencing. If amphibians can be just diverted or guided under a bridge or culvert, it is possible to use just temporary fencing without pitfall traps, i.e. drift fencing. This system without capture will only prevent them from entering a risky road. If there is no bridge or culvert, it will be necessary to capture amphibians as well as other small animals by means of temporary pitfall fencing and arrange their transport to the other side of the road or construction site. The fencing system has already been described in detail above.

Protection of existing sites. If the construction or its part (material handling route, construction yard, earth repository) is in the close vicinity of a site where specially protected animal or plant species occur, it will be necessary to protect the site against damage by construction activities by means of the above-mentioned temporary fencing, more likely drift fencing in this case.

Measures to protect birds. Any trees will be felled outside the bird nesting season.

Measures to protect ants. Immediately before actual work is started, it will be necessary to carefully walk through and inspect the whole area of groundwork. Any ant nests found will be recorded in a GPS unit and their subsequent translocation will be arranged. Experts on the Formica group will be invited to perform this.

Measures during the construction

The importance of the correct timing of construction and preventive measures has already been mentioned. Naturally, this also applies to the implementation of measures during the construction, when the risk of damage to local animal populations, including amphibians, is highest. Measures taken during the construction can be divided into several groups:

Defining environmental supervision (as part of building supervision) for the construction duration. It is absolutely necessary to have environmental supervision of the area throughout the period of construction activities. Since the function of environmental supervision has not been defined by law, even though it has been performed at a number of construction sites based on decisions of nature conservation government bodies, we recommend treating this activity as part of building supervision pursuant to Chapter

II of Act no. 183/2006 Coll. (Building and town and country planning Act), as amended.

Environmental supervision should be provided by an authorised person (or more persons), who, as part of building supervision, will supervise strict fulfilment and compliance with defined and obligatory measures aimed at minimising damage to biota in the area by the NPP Temelín construction. All significant interventions in nature must be consulted with that person at a predefined time in advance. The environmental supervisor must have the power and authorisation to order immediate reparatory measures if environmental principles are not followed. They must be regularly invited to site meetings where interventions in nature in the upcoming period will be discussed. The person must perform regular and random checks of building activities.

Protection of migration routes of amphibians. Throughout the construction period, temporary drift/pitfall fencing must be installed in the amphibian yearly activity period to prevent animals from entering roads or construction sites. The fencing will be attended by an attendant that will maintain the fence on a daily basis throughout the period of its installation except for winter (from November to February). The attendant will collect captured animals from pitfall traps, register them and carry them over to the other side of the road or construction site or directly to their breeding site. The attendant must also keep the pitfall traps absolutely clean. If the pitfall fencing is installed in the summer dry and hot period, it is advisable to place small, moistened foam sponges in the pitfall traps. This will protect captured animals from suffering or even desiccation.

Pitfall traps must be checked in the morning to protect trapped animals from sunlight and overheating or desiccation. During heavy amphibian migration, pitfall traps must be checked several times a day.

Temporary fencing of risky sections. This applies especially to sections near wetland biotopes, forest clearings, small watercourses and field boundaries. The areas may be used by amphibians and also reptiles, in particular, just during a season of the year. Nevertheless, these sections must be secured throughout the amphibian and reptile activity period. Both of these groups have major inter-species as well as intra-species differences in the use of terrestrial habitats.

Listing and plotting specific risky sections and specifying the type of fencing (drift vs. pitfall) is not possible as yet. Proposing such detail is premature until the ownership of permanently and temporarily appropriated land is resolved and material handling routes, construction yards, earth repositories, etc. are not precisely specified.

Translocation of animals from risky sections. In some sections that will be temporarily destroyed or highly damaged by construction, animals will have to be removed in advance because the areas serve as a dwelling/refuge/breeding/hibernation site for them. This section does not deal with sub-areas no. 68 and 69 in area no. 2, which will be completely destroyed in the event of construction and requires creating large substitute sites as compensatory measures.

What is described here is the case when animals must be protected by capturing and translocating them out of the construction site, or depositing them outside the construction site for the necessary time and releasing them again after the completion of construction work. This will mainly concern reptiles, especially in sub-area no. 3 - the route of a new water supply line. It will be necessary to capture animals in this sub-area and arrange their transport outside the future construction site, or further away from the construction site, or to a suitable substitute site. All these steps must be documented in great detail. If a suitable biotope for translocation is not found in the close vicinity of the construction site, temporary deposition will be performed, similarly to amphibians (see below).

In sub-area no. 3, it will be necessary to capture amphibians from the small wetland with a minute pool. The new water supply line will be routed in its close vicinity and there is a high risk for amphibians. We propose capturing amphibian specimens inhabiting the pool and depositing them temporarily in the herpetological station operated by NaturaServis s.r.o., which is located in Hradec Králové. After the completion of groundwork and final grading, all specimens would be returned back to their original habitat. This measure is more suitable for the animals that do not have to be moved to a substitute site. After the work is finished, they will be returned to their original site, possibly slightly modified or amended by adequate compensatory measures.

Accurate records of measures taken, including a final report. All measures taken need to be registered, recorded and well documented. The records, including quality photo documentation, will allow evaluating the results of each measure. Interim reports (at intervals agreed in advance) and especially annual final reports are a must.

The entire construction project will be divided into sections, including material handling routes, construction yards, places for office containers, material storage sites and earth repositories. Each section will be named, numbered and keep records of registered and translocated animals. Separate records will be kept for transport within construction sections (e.g. transport to the other side of a road or section) and for animal translocation outside the entire construction area (e.g. to a substitute site). The records will include the quantity of individual species, sex, age (adult, sub-adult, juvenile, eggs, larval stage) and especially section name and number.

D.I.7.1.5.4. Mitigation measures

As implied by their name, these measures only complement the system of other mitigation measures aimed at the target groups of plant and animal species harmed by the construction. Nevertheless, they can greatly help protect nature and the landscape. They vary considerably because they can concern constituents of the environment that is not directly damaged or destroyed by the construction. They are just a certain substitute for areas “consumed” by the construction and compensation for harmed nature and a damaged landscape. In spite of being “just” complementing, they can have a profound impact on the survival of certain species of plants and especially animals. Since they do not focus only on harmed animal groups and species, they can vary greatly.

The following mitigation measures are proposed:

Protection of birds against collision with high-voltage lines. Issues of bird protection from risks posed by high-voltage lines are dealt with e.g. in section 5 (5) of Act no. 114/92 Coll., on nature and landscape protection, as amended.

Measures to provide greater nesting opportunities for passerines. Providing nesting opportunities for small cavity birds in the broader NPP Temelín and NNPP surroundings. Universal tit nest boxes with dimensions of 12x12x25 cm and an entrance hole of 32 mm in diameter will be installed at the edges of forests and in adjacent bio-corridors in the agricultural landscape. The boxes will be located in lines, spaced 30-50 m, in suitable micro-biotopes so that they can be permanently used by cavity-nesting passerines. The target species in this area are in particular the resident great tit (*Parus major*), blue tit (*Parus caeruleus*), coal tit (*Parus ater*), Eurasian nuthatch (*Sitta europaea*). Besides birds, nest boxes are occasionally occupied by small mammals such as the hazel dormouse or wood mouse, but also by wasps, hornets and bumblebees. During autumn or winter, nest boxes must be cleared of old nests to be usable in the next season. Monitoring cavity-nesting passerines is also necessary in order to assess effectiveness.

Measures to provide greater nesting opportunities for raptors and owls. The quantities of small rodents can be decreased by hosting a sufficient number of specialised predators that can concentrate on this prey on a long-term basis, i.e. by means of natural self-regulatory mechanisms. Cavity-nesting raptors and owls constitute a highly efficient group of such predators. These include in particular the common kestrel, long-eared owl, tawny owl and other species. To resolve this problem, we recommend introducing “nesting aids” for cavity raptors and owls. In the first stage, this involves installing a basic network of nest boxes to attract and restore populations of mouse-hunting species, and then permanent maintenance of the system. Nest boxes for raptors and owls can be installed in the broader surroundings of the construction at any time during a season.

Installation of small retention aids for colonisation and biodiversity support in the surrounding environment. On the basis of a preliminary survey of opportunities for encouraging and supporting selected species of birds and flying mammals (bats), it is possible to say that the final form of the buildings can be a suitable substitute habitat for colonisation. The scope of the proposed measure is determined by the parameters of proposed construction and the biological needs of the species under consideration in the area. The species considered for inhabitation are: barn owl *(Tyto alba)* as a typical representative of species nesting in attics, church towers, hay barns, etc.; common swift *(Apus apus)* used to nest in rock fissures and crevasses, today it has moved to similar places on buildings; barn swallow *(Hirundo rustica)* lost nesting opportunities in farm buildings at the end of the last millennium and while their populations are not directly endangered, it is very useful to expand its nesting opportunities again with new opportunities on unconventional buildings - installing special bays with a rough back wall is enough for it successfully attaching its mud nest on smooth walls just under the ceiling; common house martin *(Delichon urbica)* moved from its original nesting sites on cliffs to the outer walls of buildings even deep in city neighbourhoods; black redstart *(Phoenicurus ochruros)* likes to inhabit small semi-boxes similar e.g. to holes after bricks fallen out of walls in ruins; white wagtail *(Motacilla alba)* nests on buildings in similar places as the black redstart; bats *(Chiroptera)* - since a number of species seek cavities in buildings to establish their summer colonies, there is certain anticipation that they may inhabit special bat boxes, the installation of which can provide an opportunity for enlarging the existing populations by building a suitable permanent habitat, giving us valuable information on the prevention of a decrease in this interesting group. The quantities of nest boxes, bays and supports can be increased according to the progress of colonisation in future years. Successful inhabitation by the target species will not be quick and may take several years. Another good opportunity is installing old power line pylons fitted with stork nests. By offering such suitable and, in particular, suitably located nesting sites, we can reduce the risk of them building their nests in dangerous places. Another possibility is installing wooden props in the landscape. They help raptors and owls hunt small rodents. They are simple T-shaped wooden poles. The higher a prop, the better view the predators have. Poles 150 to 200 cm high are usually used, driven into the ground and fitted with a wooden bracket on which birds sit down. Usually 5 to 10 of them are installed per hectare. When installed in an agricultural landscape, they can be removed during field work. They are also a very simple and effective protection of agricultural crops against rodents.

Measures to restore small vertebrate populations. A number of corrective measures can be proposed with respect to the possibilities and needs of effective protection of directly threatened animals, i.e. especially vertebrates, which are affected by the construction. Their goal is to prevent further degradation of animal communities and, on the contrary, creating the conditions for their positive qualitative development by means of:

- preserving and, if necessary, modifying existing habitats together with the construction of new satellite places for the generation of food sources and inhabitation by local viable populations of primarily small animals; such site may be built in a system of neighbouring bio-corridors and by clearing assumed migration routes to allow exchange of specimens among invertebrate, amphibian and reptile populations,
- using reclaimed areas around the construction, which in connection with the changes in microclimate conditions and water regimen form specific biotopes for colonisation by new animal species or groups (invertebrates, amphibians, reptiles, birds, small mammals); the gradual colonisation of the area by birds is also specific, the bird community will change as planted vegetation develops and the total production of insect biomass and other food sources changes; also interesting may be the restoration of populations of small mammals, which are often left out from biodiversity level assessment due to their hidden way of life,

- creating the conditions for colonisation of the closest vicinity of the construction, the construction itself or other associated structures by birds and bats by installing small retention aids (see above),
- performing partial revitalisation of small streams and especially making them passable for the immigration of small brook fish species (also invertebrates and birds); possible reintroduction of a suitable species of small fish concerns especially the common minnow (*Phoxinus phoxinus*), whose food range suits best the local condition; the natural occurrence of gudgeon (*Gobio gobio*) in the Vltava allows for natural propagation back to small tributaries when artificial barriers are removed.

Monitoring and subsequent removal of invasive plant species The occurrence of non-native and especially invasive plant species must be monitored and carefully recorded before surface finishing at the construction site and in the adjacent areas. Without this measure, it will not be possible to effectively eradicate such non-native species introduced or spread in the surrounding landscape by the construction. Large-scale reclamation using soil imported from other locations after the completion of construction and ground work is not recommended.

Restoration of no longer suitable pools and wetlands and creation of new biotopes, including the construction of hibernation sites. If the project is implemented, it is recommended to survey the entire broader surroundings and identify suitable areas for rehabilitation and the creation of new small water bodies and terrestrial biotopes for reptiles, as well as the creation of suitable hibernation sites that also serve as dwelling sites (stone walls are suitable).

Measures aimed at invertebrates including aquatic invertebrates. It is advisable to combine measures for invertebrates with activities aimed at amphibians. Some invertebrates can benefit from small, only periodically flooded puddles or pools. Such an environment is used e.g. by some crustaceans. Other invertebrate species even benefit from very small heaps of stones; those can also serve as refuge sites for reptiles. Another suitable measure is stacking up cut logs in piles. An interesting measure can be an “insect hotel”. It should be located near the information centre so that visitors can admire its remarkability and occupancy. The results of the biological assessment show that the planned NNPP Temelín construction and operation project will not significantly affect aquatic invertebrates in the Vltava section of interest. However, it is necessary to simultaneously monitor the current velocity, water temperature and sedimentation of suspended particles in the section downstream of the discharge of NNP and NNPP Temelín wastewater (at Kořensko) during the construction period and especially after NNPP commissioning. In terms of the potential impact of radionuclides, an analysis of the individual constituents of the aquatic environment should be performed at least once a year at the level of primary producers (auqatic macrophyta + phytoplankton), consumers (zooplankton + zoobenthos) and predators (fish) in the Vltava main channel at the point of NPP Temelín water withdrawal (at Hněvkovice) and downstream of the wastewater discharge (at Kořensko) and in the Orlík reservoir. Corrective measures must be taken if limit values are exceeded. A minimum residual flow rate at the level of $(Q_{355d}+Q_{364d})x0.5$, i.e. 5.37 $m^3.s^{-1}$ is required to be maintained in the Vltava section downstream of the dam of the Hněvkovice reservoir, which is not affected by permanent backwater from the Orlík and Kořensko reservoirs.

Removal of illegal dump sites. The measure is aimed not only at small illegal dump sites but also at waste generated during the construction. Waste management control during the construction will be part of the environmental supervisor’s duties.

Subsequent care of constructed measures. If the above measures are implemented, they will need to be maintained “in working order” in a manner that will not affect the living conditions of populations in question.

It is clear from the information provided that a number of possible measures that are not commonly implemented within such a scope as yet are proposed and justified. These proposals should not only minimise the negative impact of the construction on the immediate surroundings of the nuclear power plant, but also strengthen local animal populations and allow them to even out losses arising from the damage to or destruction of their biotopes, or even the kills caused by the construction. A number of no longer functional or completely defunct biotopes and habitats will be restored within the compensatory measures. In addition, some new habitats such as pools, ponds, periodically flooded pools, stone walls for reptiles and many more will be created. A number of measures for small passerines, owls and raptors will be created. Many nest supports for swallows, martins, redstarts and barn owls will be installed. Migration obstacles in streams will be removed, allowing the return of a whole range of species that were “flushed out” by high water or disappeared due to limiting factors. To be able to take advantage of knowledge gathered from the implemented compensatory measures, it will be necessary to monitor and continually evaluate the measures. Continual care and maintenance of the built habitats is proposed. Only this will provide a comprehensive overview of the success of the whole package of compensatory measures. For instance, it is not possible to expect a desirable occupancy of nest boxes sooner than in the third year of installation. Only time and systematic monitoring and evaluation will show how successful the individual measures have been and how the individual animal populations have strengthened. Subsequent maintenance, monitoring and evaluation will require professionals that will define adequate procedures and adequate time for individual tasks; this is why a specific schedule is not and cannot be proposed here.

D.I.7.2. Impacts on specially protected areas and Natura 2000 sites

2. PROJECT (UNITS 3+4)

Impacts on specially protected areas and Natura 2000 sites are discussed for the entire power plant as a whole in the following subsection.

PLANT (UNITS 1+2+3+4)

No specially protected area has such a location in relation to the existing NPP Temelín and the proposed NNPP project that it could be threatened or damaged by the project or activities related to the project.

As for sites of Community importance and bird areas, the Regional Authority of South Bohemia issued its opinion pursuant to Section 45 (i) of Act no.114/1992 Coll., on nature and landscape protection, as amended, according to which the project will not have any impact on sites of Community importance or bird areas within the competence of the Regional Authority of South Bohemia (opinion ref. no. KUJCK 21514/2008 OZZL/2 Tr., dated 10 July 2008).

D.I.7.3. Impacts on territorial systems of ecological stability and other elements of protection

2. PROJECT (UNITS 3+4)

The construction of the actual NNPP units will not affect or impact any TSES elements or PLFs.

The execution of related constructions (i.e. power output from the NNPP to the Kočín switchyard and reconstruction of the raw water supply line from the Hněvkovice reservoir) will affect TSES elements and PLFs. Those TSES elements and PLFs, however, are already affected by the current NPP Temelín operation. Therefore the impacts on TSES and PLFs are discussed for the entire power plant as a whole in the following subsection.

PLANT (UNITS 1+2+3+4)

No TSES elements will be affected in connection with the construction of the actual NNPP Temelín units. The NNPP power output line to the Kočín switchyard will cross a bio-corridor of local importance, as does the existing power output line. TSES elements can also be potentially affected during the possible renovation or increase of capacity of the existing raw water supply line from the Hněvkovice reservoir.

Overview of affected and potentially affected TSES elements:

Construction of the actual NNPP Temelín units	No TSES elements will be affected
Power output from the NNPP to Kočín switchyard	LBK 2a Malešický Brook LBC
Renovation of raw water supply line from Hněvkovice reservoir	NBK 2 Vltava

NBK 29 Klapačka
LBC 9 Litoradlice
LBK 15a Studený Brook
LBK 25 Březí - Podhájí
LBK 28 Hradní strouha

As for the crossing of an unnamed LBC and biocorridor LBK 2a with the power output line from NNPP Temelín to the Kočín switchyard, it is necessary to differentiate between its parts out of range of the HV line, which will not be affected by the HV line, and parts where it will be necessary to meet requirements for stand height under a HV line.

To comply with stand height limits (3 m) in the HV line protection zone, it is not possible to plant trees in the LBK 2a area as planned in the draft municipal plan of Temelín. Soil at the planned crossing of the HV line and LBK 2a is humid to wet and succession of hydrophilous and heliophilous fast-growing pioneer woody plants (willow, alder, aspen) can be expected without mowing. Woody vegetation will be regularly cut (this method of maintenance is already applied under the existing line) and will form thick, low stands like today. This maintenance method preserves the required local bio-corridor properties in the area - in particular, it allows organisms to migrate and reduces the impact of the HV line crossing the bio-corridor. The bio-corridor section outside the overhead line protection zone can be put into the target LBK condition according to the Temelín draft municipal plan.

TSES structures can also be potentially affected during the possible renovation or increase of capacity of the existing raw water supply line from the Hněvkovice reservoir.

If carried out, construction work on water supply line renovation will have an impact on a strip of biotope mosaic above the existing supply line. However, the impacts can be considered reversible. The intervention by construction will not differ from the intervention during the construction of the NPP Temelín supply line in the 1990s. Virtually no traces of the construction work can be seen in the landscape today, as its impacts were fully reversible. Consequently, the same reversible response can be expected for a similar construction activity if it happens today. Spatial parameters needed to keep TSES elements functional will be preserved.

If construction work is executed, its impact can be minimised by sowing and planting original herb and wood species afterwards, especially with respect to preventing an invasion of undesirable neophytes and ruderal species. If sowing and follow-up management manage to prevent the penetration of undesirable species, the impact on all above-mentioned structures will be fully reversible within about ten years.

Overview of affected and potentially affected prominent landscape features

Vltava — The Vltava, its characteristics from České Budějovice down to the Orlík reservoir dam, is surveyed in several separate studies and NNPP impacts on physicochemical water parameters and hydrological characteristics (radioactivity, warming, water withdrawal, water flow rates, sedimentation) are discussed in a study by Hanslík et al (2009). Data on the current condition of the Vltava aquatic environment, including forecasts for impacts thereon, are included in sections C.2.7 and D.I.7 hereof. The function of this prominent landscape feature will not be affected.

Malešický Brook — The planned power output line from NNPP Temelín to the Kočín switchyard crosses a small watercourse and accompanying stands of shrubs and trees. Mostly common species of agrocenoses and secondary biotopes of an agricultural landscape were found in the area and the HV line crossing it will not change its prominent landscape feature functions.

Forest stand at "elevation point 503 m above sea level". The planned power output line from NNPP Temelín to the Kočín switchyard crosses a game refuge southwest of elevation point 503 m above sea level. The preliminarily specified corridor for power output from NNPP Temelín to the Kočín switchyard crosses the eastern tip of this game refuge, which means that if the HV line is built in its westernmost variant, it will be necessary to cut down this forest spur and maintain a 20 m wide protection zone with stand not higher than 3 m, pursuant to Section 46 of Act no. 458/2000 Coll., on business conditions and public administration in the energy sectors and on amendment to some acts (Energy Act). The scope of this adjustment is planned not to exceed

50 m^2 (tens of trees) and will not impact the functions of this prominent landscape feature. Thus, it is not destruction of or an irreversible change in a PLF as defined by law.

D.I.7.4. Impacts during the preparation and implementation period

Impacts in the preparation and implementation period are assessed above.

D.I.7.5. Impacts in the shutdown period

Impacts in the shutdown period will not exceed impacts in the preparation and implementation period or in the period of actual operation. It is not possible to assume any extensive reclamation work that would affect natural or near-natural areas. Any dismantling and demolition work will be carried out in the power plant buildings and areas.

D.I.8. Impacts on the landscape

D.I.8.1. Impacts on landscape character

2. PROJECT (UNITS 3+4)

There are several NNPP alternatives under consideration, all consisting of two generation units, four cooling tower and a number of smaller structures with process equipment and offices, i.e. with a building structure corresponding to the existing Temelín Power Plant. From the visual point of view, the assessed project can be described as extending the existing power plant by a new nuclear power plant into a resulting symmetrical formation with high cooling tower structures on the sides and lower production and administrative buildings in the middle of the skyline.

The NNPP alternatives under consideration are divided into two power output alternatives: power output alternatives up to 1200 MW_e (with two cooling towers per unit) and power alternatives up to 1700 MW_e (with two cooling towers per unit). The two power output alternatives also represent two dimensional variants - a higher installed capacity requires more massive structures overall. This was taken into consideration during the selection of assessed model variants for the assessment of impacts on the landscape character, which resulted in three situations to be assessed:

- variant E (existing) - NPP Temelín in its current form (i.e. a zero variant from a methodological point of view),
- variant S (small) - NPP Temelín with newly built NNPP with power output up to 1200 MW_e,
- variant L (large) - NPP Temelín with newly built NNPP with power output up to 1700 MW_e.

In addition, the impact of the technical concept of one cooling tower per reactor unit (only 2x1200 MW_e power output) was assessed. A comparison between the impacts of this solution and the impacts of the above-mentioned variants shows that they differ only insignificantly, or do not differ at all, in all assessed aspects of impacts on the landscape character. The impact of this solution thus corresponds in all aspects to the partial and overall impacts specified below. The only major difference in the visual manifestation of this solution is a rather notable asymmetry of the power plant skyline in the panoramas, caused by different numbers of towers in the existing (southeastern) and planned (northwestern) NPP Temelín cooling units.

The G.L. Impact method, version Block 1.10, based on the direct calculation of building visual impacts by a specific cumulative algorithm making use of a digital terrain model, was used to determine basic assessed parameters of the visually affected area for the above-mentioned three variants, using two versions of the underlying digital terrain model - a clear relief (without forests) and a relief including forests as a covering element. A similar method was used to assess the visibility of vapour plumes above cooling towers.

The results of this stage of work included a rather significant methodological conclusion for future assessment stages - because of the extent of forests in the area of interest, the quality of the forests and their current and future role in the assessed landscape, the detailed assessment of project impacts on the landscape character is based only on models including forests as a covering element, with only building visibility areas being assessed in detail rather than area parts visually affected by cooling tower plumes alone.

Another methodological conclusion for the detailed assessment stages resulted from a specific phenomenon that started to manifest itself in the early NPP Temelín models of visual impacts and was subsequently confirmed when photo documentation was made - the whole large area of visibility of the assessed construction is rather distinctly divided into an inner and an outer circle, differing in the intensity of the project's visual impact and in the construction's ability to appear in landscape panoramas, i.e. its possible collision with fundamental landscape character values pursuant to Section 12 of Act no. 114/1992 Coll. Therefore, different methodological approaches were chosen to assess the degree of project manifestation, defined as the degree of collision with fundamental landscape character values, in the individual circles:

- In the marginally affected area in the outer circle, the degree of manifestation was determined by standard empirical expert rating with a detailed commentary on any relatively significant situations.
- In the considerably more complex conditions of the inner circle, the degree of manifestation was determined by a graphical and statistical analysis of collision maps, which in terms of methodology represent a product of maps of the visual impact of the construction and maps of the visual impact of the above-mentioned fundamental landscape character values.

Based on the results of digital models of the visual impact of the assessed project, the area of interest could be subdivided into smaller affected landscape units for detailed assessment. In order to avoid unnecessary conflicts of the different concepts and ambiguities resulting from them, the subdivision was based on the identification of landscape character areas in the General Scope of the Landscape Features of the South-Bohemian Region (Vorel et al 2009).

The area assessed (including potentially affected parts of Austria) was thus divided into a total of 44 affected landscape units (ALU), 12 ALUs in the inner circle and 32 ALUs in the outer circle, and the following aspects and parameters were identified and assessed in the delimited and subdivided area using the methodological procedures described above:

- the scope of the visually affected area and the project's visual impact under the individual variants assessed,
- change in the total scope (surface area) of the visually affected area after NNPP completion (comparison of individual assessed variants),
- change in the construction's visual impact after NNPP completion (comparison of individual assessed variants),
- the construction's impact on the landscape character of identified affected landscape units,
- the overall impact of the construction on the landscape character of the affected area,
- the impact of the NPP Temelín - Kočín line (NNPP power output) was assessed separately in terms of scale and methodology.

Since the new nuclear power plant is an extension to the existing NPP Temelín, landscape character assessment is performed to a great extent as a differential analysis of the existing and planned situations. Assessment results can be summarised into the following subsections, arranged into several topics for reasons of clarity:

Impact of the HV NPP Temelín - Kočín line (NNPP power output):

I. The impact of the construction of HV 110 and 440 kV lines (NNPP power output) from the Temelín Power Plant to the Kočín switchyard can be considered insignificant from the point of view of landscape character.

Basic characteristics and parameters of the assessed area:

II. The visually affected area has a rather regular rectangular shape with corners in the areas of Železná Ruda, Rožmitál, Počátky and Freistadt (Austria). The shape of the area of interest results from the marked tectonic predisposition of the relief of the Bohemian Massif, here manifesting itself mainly in the WNW-ESE and NNE-SSW directions.

III. With respect to subsection II, the maximum theoretically affectable area, covered by statistical comparative analyses, was defined as a rounded, approximately rectangular polygon with edge points located 60-88 km from NPP Temelín; the defined area has a total surface of 15,647 km^2.

Results of models for individual assessed variants and conclusions from their statistical comparison:

IV. In the maximum theoretically affectable area of 15,647 km^2, the existing NPP Temelín visually affects about 20.4% of the total area according to the model not including the covering capacity of forests (E_0); the planned states S_0 and L_0 affect 22.8% and 23.7% respectively. In the model including the covering capacity of forests, much closer to the real situation, the existing power plant (E) visually affects 7.2% of the total area, variants S and L produce values of 8.5% and 9.0% respectively.

Table D.I.130: Extent and comparison of visually affected territories for assessed alternatives, excluding the masking capacity of forests

	Variant			
	E_0	S_0	L_0	L_0-S_0
Visually affected area - km^2	3,202	3,574	3,711	
Ditto - % of assessed area	20.4	22.8	23.7	
Increase - km^2	0	372	509	137
Increase - % of assessed area	0	2.4	3.3	0.9
Increase - % of visually affected area S_0	0	11.6	15.9	4.3

Table D.I.131: Extent and comparison of visually affected territories for assessed alternatives, including the masking capacity of forests

	Variant			
	E	S	L	L-S
Visually affected area - km^2	1,126	1,337	1,405	
Ditto - % of assessed area	7.2	8.5	9.0	
Increase - km^2	0	211	279	68
Increase - % of assessed area	0	1.3	1.8	0.5
Increase - % of visually affected area S	0	18.7	24.8	6.1

V. The increase in visual effect on the assessed area after NNPP completion against the existing situation is a few percent (1.3-3.3% depending on the variant and no-forest/forest terrain model), so it can be considered of little significance; the difference between NNPP variants S and L is insignificant.

VI. The visual impact of NPP Temelín after NNPP completion will remain at the same level as today in about 44-54% of the affected area (depending on the variant and no-forest/forest terrain model), in another 45-52% it will increase by no more than 1 degree and only in 0.6-3.7% will the construction's impact grow by more than 1 degree on the rating scale (see the table below). Consequently, the increase in the visual impact of the construction after NNPP completion can in general be considered of little significance (mostly) to moderately significant (in the closer vicinity of NPP Temelín) in both assessed variants; the difference between the two NNPP power output alternatives is once again insignificant from this point of view (their impacts are identical in 74-78% of the visually affected area and differ by half a degree on the rating scale in another 21-25%).

Table D.I.132: Increased impact of NPP Temelín after NNPP completion for each assessed variant

Increase in visual impact	Compared variants					
	E_0×S_0	E_0×L_0	L_0×S_0	E×S	E×L	L×S
±0	54.01%	47.64%	78.46%	50.69%	43.91%	74.07%
+0.5 degree	35.05%	31.72%	20.99%	36.75%	33.57%	24.92%
+1 degree	10.34%	18.71%	0.49%	11.00%	18.87%	0.91%
+1.5 degrees	0.43%	1.42%	0.05%	0.96%	2.55%	0.08%
+2 degrees	0.09%	0.34%	0.01%	0.31%	0.56%	0.02%
+2.5 degrees	0.04%	0.09%	-	0.14%	0.27%	-
+3 degrees	0.02%	0.04%	-	0.07%	0.12%	-
+3.5 degrees	0.01%	0.02%	-	0.05%	0.08%	-

+4 degrees	0.01%	0.01%	-	0.04%	0.08%	-

VII. Existing forests in the area reduce NPP Temelín visibility in the landscape by about 62-65% (see the table below); the difference between visually affected areas in the forest and no-forest models can therefore be considered highly significant for all assessed variants, with variants S and L differing only insignificantly (by 0.5% of the affected area).

Table D.I.133: Comparison of extent of visually affected territory in deforested and forested structure visibility models

Visually affected area	Compared variants		
	E_0×E	S_0×S	L_0×L
In no-forest model (%)	100.0	100.0	100.0
In forest model (%)	34.5	36.7	37.1
Difference (%)	65.5	63.3	62.9

Results of the cooling tower plume visibility model:

VIII. The maximum range of plume visibility does not exceed (with insignificant exceptions) the specified maximum theoretical range of visibility of NPP Temelín structures (subsection III); inside the territory of interest, plumes increase the area of NPP Temelín visibility mainly in flatter parts with an open horizon behind which the actual (otherwise invisible) NPP Temelín construction is located.

IX. In terms of their impact on landscape character, plumes represent only a somewhat unusual vertical cloud, reminding about the existence of a more or less distant NPP Temelín but not affecting the landscape in the affected area on its own.

Other overall characteristics of the construction's visual impact:

X. The visual impact of NPP Temelín in the landscape is markedly anisotropic - it is much lower in the northwestern and southeastern quadrant of the affected area (i.e. in the directions of elongation of the longer axis of the NPP Temelín ground plan) than in approximate perpendicular directions. This is because a significant mutual covering effect of the individual structures comes into play in the directions of elongation of the longer axis of the ground plan of the assessed construction, while a full-width projection of the power plant, with virtually no covering of structures, can be seen in the northeastern and southwestern quadrants.

XI. The unit design of NPP Temelín (non-continuous ground plan and skyline with different heights) is reflected in the specific visibility of the construction in the landscape - either the entire power plant is visible, including smaller structures, or just the highest parts of the cooling towers protruding above horizons or forests can be seen; in-between situations are relatively sporadic.

XII. The entire large area of visibility of the assessed construction is divided into two circles, inner and outer, depending on the NPP Temelín visibility in panoramic views.

a) In views from the outer circle, from prevailingly elevated points of view, NPP Temelín is projected on a background of the more distant landscape and is not so dominant and often not even so prominent in the panoramas.

b) The inner circle offers prevailing views in which NPP Temelín is seen from below or approximately from the level of the observer, and in which it then usually contrasts against the sky and becomes a dominant or at least conspicuous element in panoramic views.

Impact of the assessed construction on the landscape character of identified areas:

XIII. Based on the results of analytical methods applied and own reconnaissance of the area of interest, the impact of NPP Temelín (variant E) on the landscape character of identified landscape units was determined as follows:

a) Mostly insignificant, marginally up to a little significant with a prevailing indifferent (neutral) to slightly negative manifestation in the ALUs of the outer circle.

b) Mostly insignificant with a prevailing indifferent (neutral) manifestation in the Kamenný Újezd ALU as the least affected ALU of the inner circle and highly significant to determining with a prevailing slightly to moderately negative manifestation in the Temelín ALU as the most affected ALU of the inner circle; the impact of the construction in the other ALUs of the inner circle ranges between the two extremes (see the table below).

XIV. In a similar manner, using photorealistic visualisations, the impact of NPP Temelín after the completion of the NNPP in both assessed variants (S and L) on the landscape character of affected landscape units was determined as follows:

a) Insignificant to a little significant with a prevailing indifferent (neutral) to slightly negative manifestation in the ALUs of the outer circle.

b) Mostly insignificant to a little significant still with a prevailing neutral manifestation in the Kamenný Újezd ALU and highly significant to determining with a prevailing slightly to moderately negative manifestation, however with a distinctive shift towards a determining impact and moderately negative manifestation, in the Temelín ALU; the assumed impact of the project in the other ALUs of the inner circle ranges again between the two extremes (see the table below).

XV. In addition, the impact of NPP Temelín in all modelled conditions (E, S, L) was assessed separately for legally defined areas of increased protection of landscape character and cultural and historical values (national parks, protected landscape areas, natural parks, landscape conservation zones) within the maximum visibility range, with the following results:

a) The assessed construction will affect only two areas in this category in a more significant manner:

- Libějovice - Lomec landscape conservation zone; however, mostly just a heavily farmed landscape in the northern and eastern foreland of the axial landscape composition, hidden in forests and actual park vegetation, is affected.
- Blanský les PLA, more specifically its northern edge with concentrated villages of conservational value (Holašovice, Lipanovice, Dobčice); however, the visual effect on them can be considered marginal, as is the effect on the entire PLA.

b) All other large-scale areas of increased landscape character protection in the range of NPP Temelín visibility (32 in total) are already affected, either marginally or insignificantly due to considerable viewing distances, or they are completely out of visual contact with NPP Temelín.

XVI. In terms of the objectives and conditions of landscape character protection in the South Bohemia Region, according to Vorel et al 2009, the assessed project may be in collision especially with the group of conditions for the visual protection of reliefs, horizons, natural and cultural dominants and urban skylines, due to its prominent position (determined, however, by the location of the existing NPP Temelín). However, the results of differential analysis show that the increase in visually affected area after NNPP completion, in comparison with the existing situation, is of little significance (subsection V), as is the increase in the visual impact of the construction (subsection VI). It is then possible to say that virtually all collisions of this type are caused already by NPP Temelín and the NNPP extension will not cause any significant visual collisions; it will only slightly accentuate some of them.

Consequently, the impact of the actual assessed project, i.e. the construction of a new nuclear power plant, defined as a change in the existing NPP Temelín impact on the NNPP extension against the NPP in its current form, can be assessed in both evaluated variants (S and L) as follows:

- mostly little to moderately significant (up to highly significant in exceptional cases) with a prevailing slightly to moderately negative manifestation in affected landscape units in the inner circle (see the table below),
- little significance to insignificant with a prevailing slightly negative to indifferent (neutral) manifestation in the outer circle area (see the table below).
- insignificant with an indifferent (neutral) manifestation in the affected parts of Austria, marginal representation, the relatively least affected units of the outer circle.

The above conclusion stating relatively low levels of significance of the impact under investigation for a construction with structures up to 180 m high can be explained by a combination of several circumstances:

- in this territory of otherwise fair natural, cultural, historical and landscaping importance, the existing Temelín Power Plant already affects landscape segments, in particular to a rather moderate or less-than-moderate extent from this point of view.
- The total increase of the visually affected area after NNPP completion is relatively low (see subsection V), which means that almost the same territory as today, and virtually the same set of fundamental landscape character values pursuant to Section 12 of the Czech National Council Act no. 114/1992 Coll., will be visually affected.

- The increase in the construction's visual impact after NNPP completion is mostly of little significance as well (see subsection VI), which in the given case means only a slight increase in the significance of possible collisions between the project and the virtually unaltered set of fundamental landscape character values, i.e. generally prevailing little significant increase in the level of negativity of the construction's manifestation.

Table D.I.134: Overview of results of NPP Temelín impact assessment on the landscape character of affected landscape units of the inner circle and areas of the outer circle

Affected landscape unit	Impact of NPP Temelín				Change in NPP Temelín impact after NNPP completion
	Existing (variant E)		With NNPP (variants S and L)		
	Intensity	Manifestation	Intensity	Manifestation	
Temelín area	3 / 4	-1 / -2	4 > 3	-2 > -1	Moderately significant
Týn nad Vltavou area	2 / 3	-1 / -2	3 > 4	-2	Moderately significant
Bechyně area	1 / 2	0 / -1	2 > 1	-1	Little to moderately significant
Veselská Blata	0 / 1	0 / -1	0 / 1	-1	Little to moderately significant
Opařany area	0 / 1	0	1 / 2	0 > -1	Little significant
Bernartice area	0 / 1	0 / -1	1 / 2	0 / -1	Little significant
Putim-Protivín area	0 > 1	0 > -1	1 > 2	-1 > 0	Moderately significant
Zliv basin	1 / 2	-1 > 0	2 / 3	-1 > -2	Moderately to highly significant
Netolice area	1 > 2	-1	2 > 3	-1 / -2	Little to moderately significant
České Budějovice metropolitan area	0	0	1	0	Little significant to insignificant
Blanský les PLA	0 / 1	0 / -1	1	-1 > -2	Little significant
Kamenný Újezd area	0	0	0 / 1	0 > -1	Little significant to insignificant
ALUs in outer circle	0 > 1	0 > -1	0 / 1	0 > -1	Little significant to insignificant

Note: The usual scale is used for impact quantification (intensity) in the table: 0 - insignificant or non-existent impact, 1 - little significance, 2 - (moderately) significant, 3 - highly significant, 4 - determining impact; manifestation quantification uses the following scale: 0 - indifferent manifestation, -1 - slightly negative, -2 - (moderately) negative, -3 - highly negative, -4 - degrading (the project is not expected to have a positive impact on landscape character, so the positive part of the scale is not used).

PLANT (UNITS 1+2+3+4)

The impact of the entire NPP Temelín after the completion of units 3 and 4 on landscape character has been mentioned above in subsection XIV, so it can be assessed in both evaluated variants (S and L) as follows:

- Mostly insignificant to little significance with a prevailing neutral manifestation in the affected landscape unit of Kamenný Újezd, as the least affected area of the inner circle, and mostly determining with a prevailing moderately negative manifestation in the Temelín ALU as the most affected ALU of the inner circle; the project's assumed impact in the other ALUs of the inner circle ranges between the two extremes.
- Insignificant to little significance with a prevailing indifferent (neutral) to slightly negative manifestation in the area of the outer circle.
- Insignificant with an indifferent (neutral) manifestation in the affected parts of Austria.

D.I.8.2. Impacts on area shading

PROJECT (UNITS 3+4)

The assessment of possible shading of surrounding residential areas by NPP Temelín after the completion of a new nuclear power plant used the same variants as the landscape character assessment:

- variant E (existing) - NPP in its current form (i.e. a zero variant from a methodological point of view),
- variant S (small) - NPP with newly built NNPP with power output up to 1200 MW_e,
- variant L (large) - NPP with newly built NNPP with power output up to 1700 MW_e.

The alternatives assume building two cooling towers per generating unit. In addition, the impact of the technical concept of one cooling tower per generating unit (only 2x1200 MW_e power output) was assessed. A comparison between the impacts of this solution and the impacts of the above-mentioned variants shows that the overall scope of shaded area is virtually identical, with very similar shading times.

The G.L.I. SHADE 3.93 software system, based on graphical and data analysis of the assessed situation using a digital terrain model, was used to specify two basic parameters for the assessed variants, determining the impact of the phenomenon under investigation in a specific evaluated area: total extent of shaded area and detailed times of shading at selected reference points, accurate to minutes. The total annual cumulative exposure is presented both as a theoretical model maximum (assuming a permanently sunny sky) and adjusted to real total amounts of sunlight at a site (based on data from the CHMI Temelín observatory).

The relevant area of shading within about 5 km from NPP Temelín includes a number of residential areas, which were represented by more closely assessed reference points RP00-RP26 for the purposes of this assessment; the reference points were defined so that there was at least one reference point in each potentially shaded residential community in the area of interest, including individual isolated houses, summer house sites and holiday resorts (see the table below).

Table D.I.135: Overview of reference points for the calculation of shading of residential areas around NPP Temelín

No.	Municipality	Location	No.	Municipality	Location
RP00	Temelín	Podhájí - U Pištory gamekeeper's lodge	RP14	Týn n. Vlt.	Račina
RP01	Temelín	Temelín - village centre	RP15	Týn n. Vlt.	Bedrnická gamekeeper's lodge
RP02	Temelín	Temelín - nursing home	RP16	Týn n. Vlt.	Předčice
RP03	Temelín	Kaliště - southeastern edge of the village	RP17	Týn n. Vlt.	Břehy
RP04	Temelín	Isolated house at Rozovy	RP18	Týn n. Vlt.	Hněvkovice - vocational school
RP05	Temelín	Planovy	RP19	Hluboká n. Vlt.	Hněvkovice - holiday resort
RP06	Temelín	Lhota pod Horami – NE edge of the village	RP20	Hluboká n. Vlt.	Jeznice
RP07	Temelín	Sedlec - eastern edge of the village	RP21	Dříteň	Malešice - eastern edge of the village
RP08	Temelín	Litoradlice - eastern edge of the village	RP22	Dříteň	Malešice - western edge of the village
RP09	Temelín	Zvěrkovice - southern edge of the village	RP23	Dříteň	Chvalešovice - NE edge of the village
RP10	Temelín	Záluží	RP24	Dříteň	Bílá Hůrka
RP11	Týn n. Vlt.	Isolated house at U Bulků	RP25	Dříteň	Strachovice
RP12	Týn n. Vlt.	Isolated houses at Zadní Kohout	RP26	Protivín	Těšínov - Fanfíry
RP13	Týn n. Vlt.	Týn nad Vltavou - E edge of the town			

Assessment results show that the impact of both NNPP variants is very similar in the area of interest:

- The extent of the shaded area is virtually identical for the S and L variants.
- In terms of shading times, most reference points are impacted insignificantly; the level of low significance, with a total cumulative exposure exceeding 6 hours per year at maximum daily intervals of 15-77 min., is reached by the shading impact at RP00-RP02, RP05 (for variant L), RP07, RP23 and RP24 (for variant S).
- In terms of NNPP contributions, the increase in monitored parameters can be considered significant at points RP01 and RP07 (for variant L only) and of little significance at points RP00, RP02, RP05, RP06, RP09, RP10, RP23 and RP24. The increase in monitored parameters at the other reference points is insignificant, including points RP13 and RP14, which are located outside the existing NPP Temelín shaded area and will only be shaded by NNPP structures.

Table D.I.136: Overview of contributions from NNPP Temelín in variant S to monitored shading parameters at assessed reference points

Reference point		RP00	RP01	RP02	RP03	RP04	RP05	RP06	RP07	RP08
Increase in the total number of days of shading during a year	Days:	42	25	46	0	17	30	40	89	26
Increase in the maximum daily period of shading	Minutes:	0	35	26	11	10	7	7	11	0
Increase in the max. theoretical cumulative exposure	Hours per year:	9.6	51.7	36.4	6.0	6.5	10.3	9.2	21.5	4.3
Increase in total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	3.9	11.6	8.6	1.2	1.6	3.6	3.7	10.7	2.1
	% of annual duration of sunlight:	0.22	0.63	0.47	0.06	0.09	0.20	0.20	0.59	0.11

Reference point		RP09	RP10	RP11	RP12	RP13	RP14	RP15	RP16	RP17
Increase in the total number of days of shading during a year	Days:	41	71	70	53	38	45	36	40	22
Increase in the maximum daily period of shading	Minutes:	11	23	19	9	8	12	7	7	0
Increase in the max. theoretical cumulative exposure	Hours per year:	10.9	21.3	13.4	7.0	3.9	4.5	3.2	3.4	2.7

Increase in total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	3.1	4.5	2.8	1.8	0.8	1.1	0.7	0.8	0.9
	% of annual duration of sunlight:	0.17	0.25	0.15	0.10	0.04	0.06	0.03	0.04	0.05
Reference point		RP18	RP19	RP20	RP21	RP22	RP23	RP24	RP25	RP26
Increase in the total number of days of shading during a year	Days:	20	19	0	6	66	67	65	44	25
Increase in the maximum daily period of shading	Minutes:	1	0	1	0	0	5	3	0	3
Increase in the max. theoretical cumulative exposure	Hours per year:	2.4	2.4	0.5	0.1	5.0	9.8	8.8	2.3	3.5
Increase in total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	0.9	0.9	0.2	0.1	2.5	5.0	4.4	1.2	1.3
	% of annual duration of sunlight:	0.05	0.05	0.01	0.01	0.13	0.28	0.24	0.07	0.07

Table D.I.137: Overview of contributions from NNPP Temelín in variant L to monitored shading parameters at assessed reference points

Reference point		RP00	RP01	RP02	RP03	RP04	RP05	RP06	RP07	RP08
Increase in the total number of days of shading during a year	Days:	43	25	46	0	23	30	42	95	25
Increase in the maximum daily period of shading	Minutes:	0	48	32	12	14	13	9	14	0
Increase in the max. theoretical cumulative exposure	Hours per year:	10.6	61.4	50.3	4.4	10.5	14.1	11.4	26.6	5.2
Increase in total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	4.2	13.7	11.8	0.9	2.5	4.9	4.5	13.2	2.5
	% of annual duration of sunlight:	0.23	0.75	0.64	0.05	0.14	0.27	0.25	0.72	0.13
Reference point		RP09	RP10	RP11	RP12	RP13	RP14	RP15	RP16	RP17
Increase in the total number of days of shading during a year	Days:	42	76	73	53	42	46	39	40	21
Increase in the maximum daily period of shading	Minutes:	13	24	19	11	9	13	8	8	0
Increase in the max. theoretical cumulative exposure	Hours per year:	11.5	19.3	11.5	7.5	5.0	4.6	3.6	3.4	3.2
Increase in total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	3.2	4.1	2.4	1.9	1.0	1.1	0.8	0.8	1.0
	% of annual duration of sunlight:	0.17	0.22	0.13	0.11	0.05	0.06	0.04	0.04	0.05
Reference point		RP18	RP19	RP20	RP21	RP22	RP23	RP24	RP25	RP26
Increase in the total number of days of shading during a year	Days:	21	20	5	2	58	72	66	28	26
Increase in the maximum daily period of shading	Minutes:	2	0	1	0	0	8	0	0	5
Increase in the max. theoretical cumulative exposure	Hours per year:	2.7	2.7	1.4	0.1	3.6	11.9	6.7	1.9	4.4
Increase in total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	1.0	1.0	0.5	0.1	1.8	6.0	3.4	1.0	1.7
	% of annual duration of sunlight:	0.05	0.05	0.03	0.01	0.10	0.33	0.18	0.06	0.10

- Variant L has slightly higher values of monitored parameters than variant S at virtually all reference points. However, the difference between the two variants can only be considered at least as little significance at the two nearest reference points, RP01 and RP02 (Temelín), and at RP07 (the eastern edge of Sedlec). At the other reference points, the difference between the two variants is insignificant.

Table D.I.138: Overview of differences in times of potential shading at assessed reference points for NNPP Temelín in variants L and S (difference given as L - S)

Reference point		RP00	RP01	RP02	RP03	RP04	RP05	RP06	RP07	RP08
Difference in the total number of days of shading during a year	Days:	1	0	0	0	6	0	2	6	-1
Difference in the maximum daily period of shading	Minutes:	0	13	6	1	4	6	2	3	0
Difference in the max. theoretical cumulative exposure	Hours per year:	1.0	9.7	13.9	-1.6	4.0	3.8	2.2	5.1	0.9
Difference in total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	0.3	2.1	3.2	-0.3	0.9	1.3	0.8	2.5	0.4
	% of annual duration of sunlight:	0.01	0.12	0.17	-0.01	0.05	0.07	0.05	0.13	0.02
Reference point		RP09	RP10	RP11	RP12	RP13	RP14	RP15	RP16	RP17

Difference in the total number of days of shading during a year	Days:	1	5	3	0	4	1	3	0	-1
Difference in the maximum daily period of shading	Minutes:	2	1	0	2	1	1	1	1	0
Difference in the max. theoretical cumulative exposure	Hours per year:	0.6	-2.0	-1.9	0.5	1.1	0.1	0.4	0.0	0.5
Difference in total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	0.1	-0.4	-0.4	0.1	0.2	0.0	0.1	0.0	0.1
	% of annual duration of sunlight:	0.00	-0.03	-0.02	0.01	0.01	0.00	0.01	0.00	0.00
Reference point		RP18	RP19	RP20	RP21	RP22	RP23	RP24	RP25	RP26
Difference in the total number of days of shading during a year	Days:	1	1	5	-4	-8	5	1	-16	1
Difference in the maximum daily period of shading	Minutes:	1	0	0	0	0	3	-3	0	2
Difference in the max. theoretical cumulative exposure	Hours per year:	0.3	0.3	0.9	0.0	-1.4	2.1	-2.1	-0.4	0.9
Difference in total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	0.1	0.1	0.3	0.0	-0.7	1.0	-1.0	-0.2	0.4
	% of annual duration of sunlight:	0.00	0.00	0.02	0.00	-0.03	0.05	-0.06	-0.01	0.03

PLANT (UNITS 1+2+3+4)

In general, shading by the planned NPP Temelín after NNPP completion can be assessed as significant only for Temelín (RP01 and RP02). However, the significance of the assessed impact does not consist in daily and yearly exposure values, which correspond to the level of low significance, or in the intensity of shade, which does not differ e.g. from the common shading of the Sun by clouds; rather, it consists in the season of the year and the time of day - the period of possible shading interferes with the working hours of businesses and offices and with school times during affected winter months with relatively late sunrise times. The same applies to the solution with a single cooling tower per generating unit (for the 2x1200 MW_e power alternative only), which slightly increases the parameter of shading (total cumulative exposure) in comparison with two cooling towers per generating unit (for the 2x1200 MW_e power alternative) but remains lower than the two-tower concept of the 2x1700 MW_e power alternative.

Other residential areas in the area under investigation are impacted by shading of little significance (Planovy, Sedlec, Chvalešovice, Bílá Hůrka, Podhájí - U Pištory) or insignificantly (Zvěrkovice, Záluží, Týn n. Vlt., Račina, Bedrník, Předčice, Břehy, Hněvkovice, Jeznice, Litoradice, Malešice, Strachovice, Fanfíry Lhota pod Horami, Rozovy, Kaliště) or not impacted at all (they are out of range of possible shading or covered by terrain relief).

Table D.I.139: Overview of times of possible shading at assessed reference points for the extended NPP Temelín in variant S

Reference point		RP00	RP01	RP02	RP03	RP04	RP05	RP06	RP07	RP08
Total number of days of effect	Days:	121	63	108	43	53	63	70	132	58
Maximum daily period of shading	Minutes:	32	64	49	28	26	24	21	27	19
Maximum theoretical cumulative exposure	Hours per year:	30.8	78.7	50.4	14.7	12.3	16.2	13.1	27.5	11.2
Total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	11.1	17.3	11.7	3.0	2.9	5.5	5.2	13.3	5.0
	% of annual duration of sunlight:	0.61	0.94	0.64	0.16	0.16	0.30	0.28	0.73	0.27
Reference point		RP09	RP10	RP11	RP12	RP13	RP14	RP15	RP16	RP17
Total number of days of effect	Days:	95	71	70	90	38	45	72	68	62
Maximum daily period of shading	Minutes:	21	23	19	16	8	12	11	11	14
Maximum theoretical cumulative exposure	Hours per year:	17.6	21.3	13.4	9.7	3.9	4.5	4.7	4.5	7.7
Total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	4.5	4.5	2.8	2.4	0.8	1.1	1.0	1.0	2.0
	% of annual duration of sunlight:	0.25	0.25	0.15	0.13	0.04	0.06	0.05	0.05	0.11
Reference point		RP18	RP19	RP20	RP21	RP22	RP23	RP24	RP25	RP26
Total number of days of effect	Days:	34	40	62	81	114	102	103	91	47
Maximum daily period of shading	Minutes:	11	12	15	17	15	17	15	11	13
Maximum theoretical cumulative exposure	Hours per year:	3.9	5.3	10.4	9.4	10.7	13.3	12.3	6.5	5.5
Total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	1.4	2.0	3.9	3.8	5.4	6.7	6.2	3.3	2.1
	% of annual duration of sunlight:	0.08	0.11	0.21	0.21	0.29	0.37	0.34	0.18	0.11

Table D.I.140: Overview of times of possible shading at assessed reference points for the extended NPP Temelín in variant L

Reference point		RP00	RP01	RP02	RP03	RP04	RP05	RP06	RP07	RP08
Total number of days of effect	Days:	122	63	108	43	59	63	72	138	57
Maximum daily period of shading	Minutes:	32	77	55	29	30	30	23	30	19
Maximum theoretical cumulative exposure	Hours per year:	31.8	88.4	64.3	13.1	16.3	20	15.3	32.6	12.1

Total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	11.4	19.4	14.9	2.7	3.8	6.8	6.0	15.8	5.4
	% of annual duration of sunlight:	0.62	1.06	0.81	0.15	0.21	0.37	0.33	0.86	0.29
Reference point		RP09	RP10	RP11	RP12	RP13	RP14	RP15	RP16	RP17
Total number of days of effect	Days:	96	76	73	90	42	46	75	68	61
Maximum daily period of shading	Minutes:	23	24	19	18	9	13	12	12	14
Maximum theoretical cumulative exposure	Hours per year:	18.2	19.3	11.5	10.2	5	4.6	5.1	4.5	8.2
Total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	4.6	4.1	2.4	2.5	1.0	1.1	1.1	1.0	2.1
	% of annual duration of sunlight:	0.25	0.22	0.13	0.14	0.05	0.06	0.06	0.05	0.11
Reference point		RP18	RP19	RP20	RP21	RP22	RP23	RP24	RP25	RP26
Total number of days of effect	Days:	35	41	67	77	106	107	104	75	48
Maximum daily period of shading	Minutes:	12	12	15	17	15	20	12	11	15
Maximum theoretical cumulative exposure	Hours per year:	4.2	5.6	11.3	9.4	9.3	15.4	10.2	6.1	6.4
Total cumulative exposure adjusted to long-term monthly average amounts of sunlight at the site	Hours per year:	1.5	2.1	4.2	3.8	4.7	7.7	5.2	3.1	2.5
	% of annual duration of sunlight:	0.08	0.11	0.23	0.21	0.26	0.42	0.28	0.17	0.14

D.I.8.3. Impacts on recreational uses and passability of the area

PROJECT (UNITS 3+4)

There is no infrastructure for recreational use or publicly used paths and roads in the area intended for the project. Therefore, there is no effect on the recreational use of the landscape or area passability.

Possible impacts on tourism / numbers of visitors to monuments in the surroundings are discussed in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation), specifically in its subchapter D.I.1.2. Social and economic effects.

PLANT (UNITS 1+2+3+4)

What was said above can also be applied to the power plant after expansion.

D.I.8.4. Impacts during the preparation and implementation period

The above-described impacts on the landscape will grow gradually (in particular as the height of newly built cooling towers increases) from the existing level (variant E) to levels after NNPP completion depending on the variant (S or L); the difference between the two NNPP construction variants is in general insignificant for both shading and landscape character.

D.I.8.5. Impacts in the shutdown period

The impact of the assessed construction on the landscape in the shutdown period will also depend on what will happen with the determining structure - the cooling towers. If they remain in place, the construction's impact on both landscape character and shading of surrounding residential areas will remain at the level specified above. If they are demolished, the construction's impact will decrease in both aspects (impacts on the landscape, shading impacts).

D.I.9. Impacts on tangible assets and cultural heritage

D.I.9.1. Impacts on tangible assets

PROJECT (UNITS 3+4)

The project does not require any change in the structure of communities in the affected area or demolition of existing buildings. Neither does the project affect buildings remaining in the area. Therefore, its impact on buildings can be qualified as zero impact.

Possible economic impacts (property prices, tourism, area development) are discussed in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation), specifically in its subchapter D.I.1.2. Social and economic effects.

PLANT (UNITS 1+2+3+4)

What was said above can also be applied to the power plant after expansion.

D.I.9.2. Impacts on cultural and historical heritage

PROJECT (UNITS 3+4)

The construction of a new nuclear power plant will not cause any negative impacts on architectural and other historically important heritage. The project does not require demolition of buildings in the surroundings of the power plant; it preserves their condition, environmental character and purpose.

Advance rescue archaeological research, which also covered the project site, had been carried out before the construction of the Temelín Power Plant was started. Finds from this area were recorded and mostly put in the repository of the West Bohemia Museum in Plzen. Consequently, there is no additional impact on archaeological heritage.

Possible economic impacts (tourism, numbers of visitors) are discussed in Chapter D.I.1. Impacts on the population, including socioeconomic impacts (page 372 in this documentation), specifically in its subchapter D.I.1.2. Social and economic effects.

PLANT (UNITS 1+2+3+4)

The expanded plant will have no impact on cultural and historical heritage or archaeological sites.

Funds from the Regional Grant Programme of the ČEZ Foundation are donated to the renovation and maintenance of cultural heritage. This will continue after the power plant is expanded.

D.I.9.3. Impacts during the preparation and implementation period

No cultural and historical heritage or archaeological sites will be affected during project preparation and construction.

D.I.9.4. Impacts in the shutdown period

No negative impacts on tangible assets and cultural heritage are expected in the shutdown period.

D.I.10. Impacts on transport and other infrastructures

D.I.10.1. Impacts on transport infrastructure

PROJECT (UNITS 3+4)

The table below lists roads on which a rather significant change in traffic volumes is expected as a result of the NNPP operation. The table summarises traffic volumes under future conditions[1] in 2015, excluding and including the impact of vehicles related to project operation. In addition, the difference in traffic volumes between the two situations is given as a percentage. The road sections in question are:

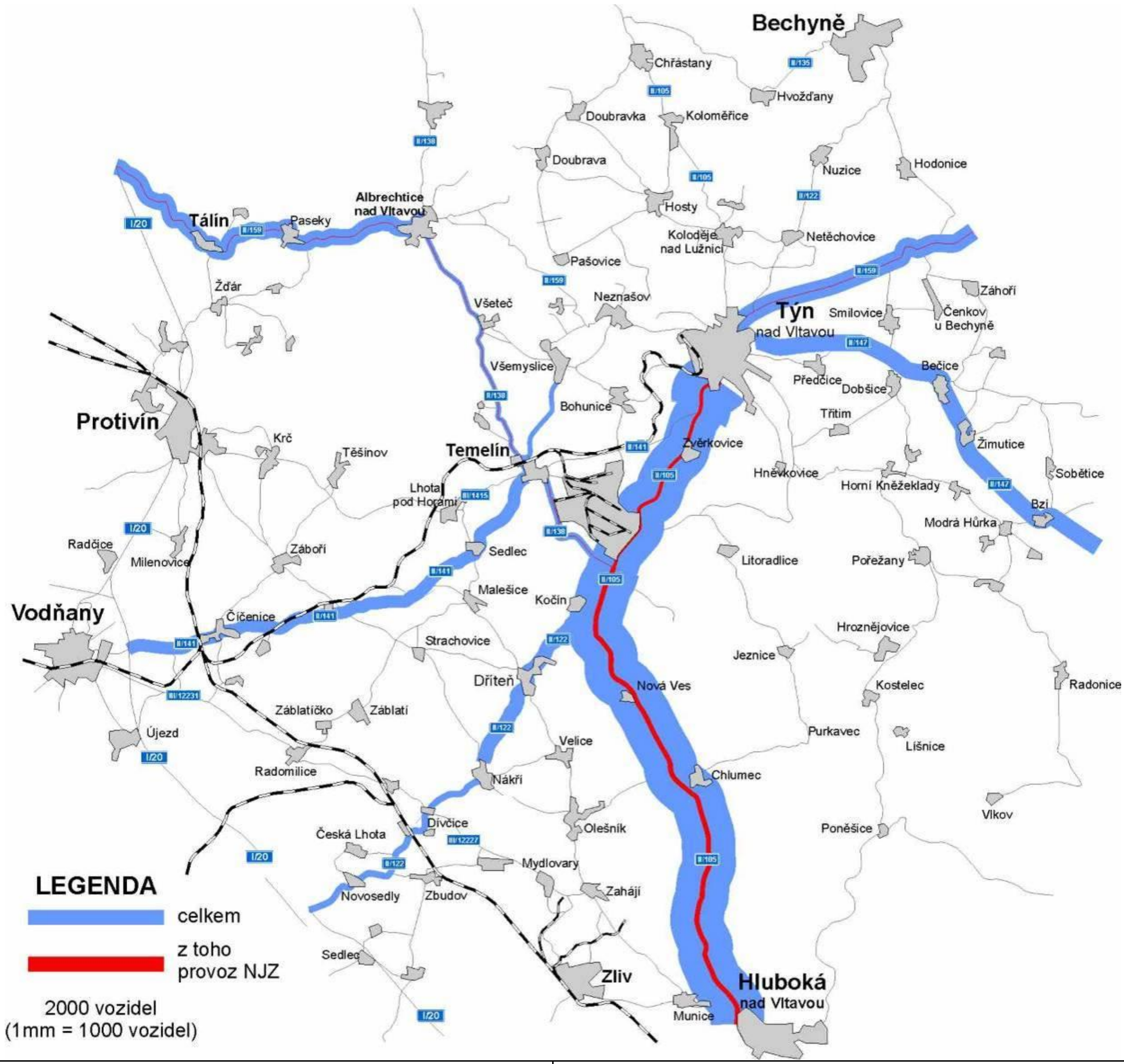
[1] Traffic volumes under future conditions in 2015 are extrapolated using current growth coefficients published by the Czech Road and Motorway Directorate for the 2005 census.

Table D.I.141: Changes in traffic volumes on the most affected roads around NPP Temelín due to NNPP operation [vehicles/24 hrs]

Road section	2015		2015 + NNPP		Change [%]	
	Total	Trucks	Total	Trucks	Total	Trucks
NNPP – Temelín	849	370	893	374	5.2	1.1
Temelín – Všeteč	442	87	486	91	10.0	4.6
Všeteč - Albrechtice nad Vltavou	601	139	645	143	7.3	2.9
Albrechtice nad Vltavou - Tálín	2,203	384	2,247	388	2.0	1.0
Crossroads of II/105 and II/138 - crossroads of II/105 and III/12221	6,457	1,454	6,869	1,496	6.4	2.9
Crossroads of II/105 and III/12221 - Týn nad Vltavou	8,187	1,370	8,599	1,412	5.0	3.1
Týn nad Vltavou - Březnice	2,437	445	2,519	453	3.4	1.8
Crossroads of II/105 and II/138 - Chlumec	6,887	1,135	7,505	1,199	9.0	5.6
Chlumec - Hluboká nad Vltavou	6,887	1,135	7,505	1,199	9.0	5.6

These changes are shown below in a volume flow diagram, which illustrates the ratio of the volume of traffic associated with project operation to the total volume of traffic expected during the operational period.

Figure D.I.17: Traffic flow diagram for the NNPP operational period



LEGENDA	LEGEND
Celkem	total

z toho provoz NJZ	of which NNPP
2000 vozidel (1 mm = 1000 vozidel)	2000 vehicles (1 mm = 1000 vehicles)

The data indicates that the traffic load of the surrounding road network will increase by no more than 10% during the NNPP operational period, with an increase in heavy traffic of 6% at most. Such an increase in traffic does not represent a significant impact on transport infrastructure in comparison with the existing load. In addition, the values are conservative; the actual increase will probably be lower.

As for railway transport, which is used at about 63% today (the capacity margin is 15 trains per day), the impact of the utilisation of railway transport can be considered insignificant.

There are no impacts on other transport infrastructure in the affected area (air, water, cycling, pedestrian traffic).

PLANT (UNITS 1+2+3+4)

The above assessment of the project (units 3+4) can be applied to the operation of the power plant as a whole, too. Current traffic volumes associated with the power plant are already included in the above flow diagram as data on the existing (background) situation.

All roads on which traffic will be present have a sufficient capacity and are properly equipped for the expected traffic. The total impact of traffic load with increased traffic volumes on the most affected roads can be considered insignificant in the operational period.

D.I.10.2. Impacts on other infrastructure

PROJECT (UNITS 3+4)

The greater part of necessary infrastructure was constructed in the full extent for the needs of a 4x1000 MW_e power plant, of which only 2 units were built. Project implementation will include the implementation of power output from the new units to the Kočín switchyard. In addition, consideration is given to increasing the capacity of raw water supply from the Hněvkovice pumping station to the power plant, which is currently provided by two DN 1600 pipelines; one pipeline of approximately DN 1600 should be added.

To secure the overall transmission capability and reliability of the Czech Republic's transmission network in connection with new and prepared energy sources (including renewable energy sources), the transmission system operator (ČEPS, a.s.) prepares the construction of a twin line, V406/V407 Kočín - Mírovka. The investment also covers the needs of power output from the NNPP.

PLANT (UNITS 1+2+3+4)

The above information can also be applied to the power plant as a whole.

D.I.10.3. Impacts during the preparation and implementation period

The table below shows road sections around the project site that will experience a significant increase in the volumes of traffic (especially truck traffic). The table summarises traffic volumes under future conditions[1] in 2015, excluding and including the impact of vehicles related to project preparation and implementation. In addition, the difference in traffic volumes between the two situations is given as a percentage. The road sections in question are:

Table D.I.142: Changes in traffic volumes on the most affected roads around NPP Temelín due to NNPP construction [vehicles/24 hrs]

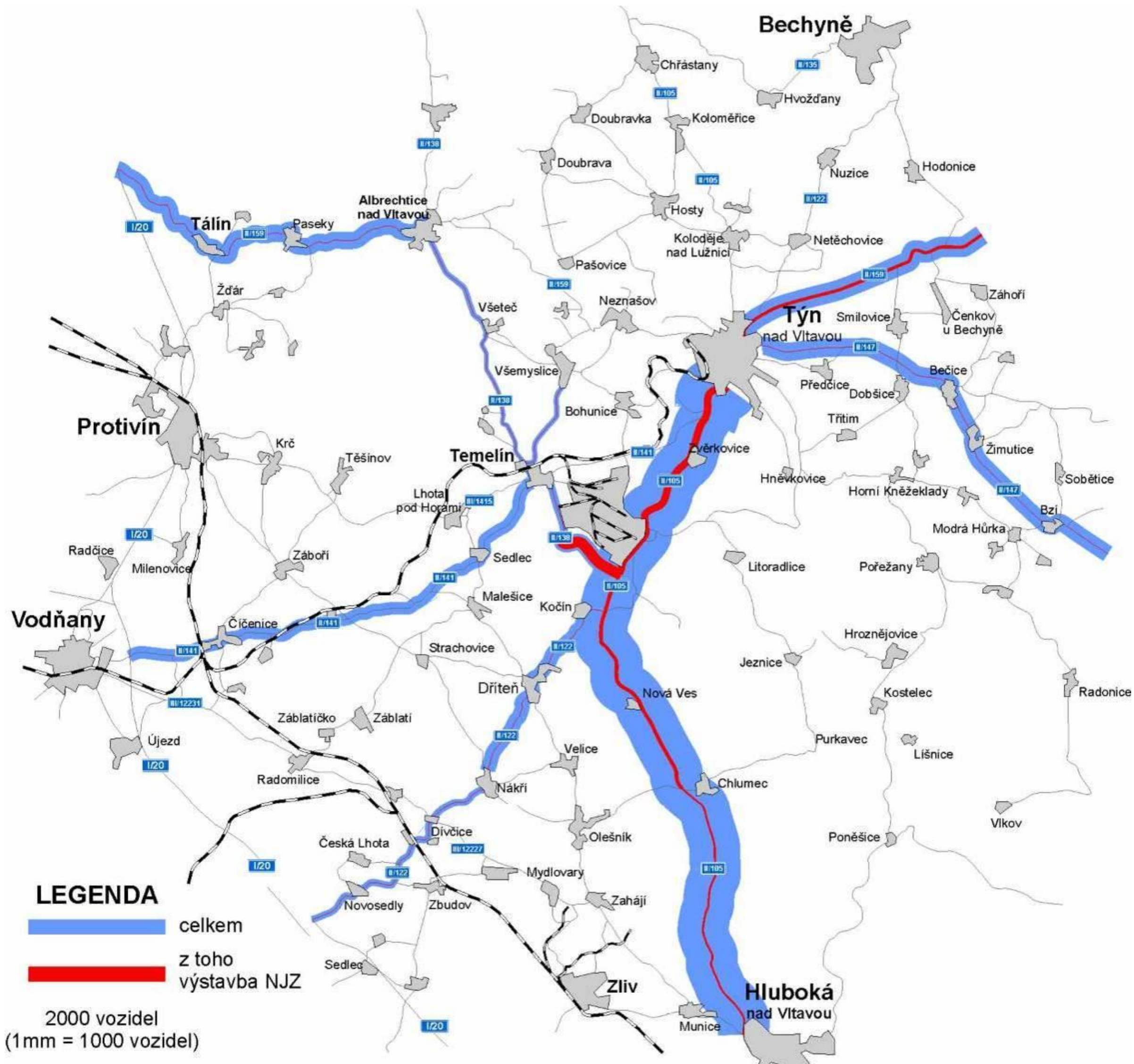
Road section	2015		2015 + NNPP		Change [%]	
	Total	Trucks	Total	Trucks	Total	Trucks

[1] Traffic volumes under future conditions in 2015 are extrapolated using current growth coefficients published by the Czech Road and Motorway Directorate for the 2005 census.

NNPP - crossroads of II/105 and II/138	849	370	2,286	1,114	169	201
NNPP - Temelín	849	370	1,012	480	19.2	29.7
Temelín - Všeteč	442	87	578	170	30.8	95.4
Všeteč - Albrechtice nad Vltavou	601	139	737	222	2.6	59.7
Albrechtice nad Vltavou - Tálín	2,203	384	2,339	469	6.2	21.6
Temelín - Všemylice	635	107	659	131	3.8	22.4
Temelín - Číčenice	1,693	476	1,696	479	0.2	0.6
Crossroads of II/105 and II/138 - crossroads of II/105 and III/12221	6,457	1,454	7,419	1,883	14.9	29.5
Crossroads of II/105 and III/12221 - Týn nad Vltavou	8,187	1,370	9,149	1,799	11.8	31.3
Týn nad Vltavou - Březnice	2,437	445	2,813	521	2.8	17.1
Týn nad Vltavou - Bečice	2,387	486	2,519	618	5.5	27.2
Bečice - Dolní Bukovsko	2,401	742	2,533	874	5.5	17.8
Crossroads of II/105 and II/138 - Chlumec	6,887	1,135	7,339	1,427	6.6	25.7
Chlumec - Hluboká nad Vltavou	6,887	1,135	7,079	1,167	2.8	2.8
Crossroads of II/105 and II/122 - Nákří	1,998	617	2,021	640	1.2	3.7
Nákří - Dívčice	886	219	909	242	2.6	10.5

These changes are shown below in a flow diagram of access route traffic, which illustrates the ratio of the volume of traffic associated with project construction to the total volume of traffic expected during the construction period.

Figure D.I.18: Traffic flow diagram for the NNPP construction period



LEGENDA	LEGEND

Celkem	Total
z toho provoz NJZ	of which NNPP
2000 vozidel (1 mm = 1000 vozidel)	2,000 vehicles (1 mm = 1,000 vehicles)

Data analysis indicates that the traffic load of the road network will in general increase by no more than about 10% during the NNPP construction period. This value is exceeded in some sections in the immediate vicinity of the construction site; up to three times in the adjacent section of road II/138, by up to 20% on road II/105 towards Týn nad Vltavou and by approximately 30 to 40% on road II/138 in the section from Temelín to Albrechtice nad Vltavou (due to the low current value of traffic load).

In addition, road sections that will experience a rather significant increase in the volume of traffic (especially truck traffic) were identified in cooperation with the South Bohemia Region. Proposals for contingent measures in those sections were made. The proposals made take account of the traffic importance of individual road sections and their location in the region's road network; preference is given to projects of lasting importance for a given road section (also after NNPP commissioning) as opposed to sections specifically affected by NNPP construction traffic. The proposals include the construction of road diversions as well as the conversion of crossroads to small roundabouts, modifications to improve road safety and alleviate negative environmental impacts (proposals for speed-reducing features, proposals for the construction of pavements, proposals for the modification of intersections in urban areas, proposals for window replacement) and conversion of the surfaces of identified road sections other than through road sections in towns and villages. A separate section deals with proposals for measures in Týn nad Vltavou. The following table shows an overview of the measures:

Table D.I.143: Recapitulation of proposed measures

Road	Proposed measure	Measure description - municipality (location)
II/105	Me1-2	Zvěrkovice measure (roundabout "U Bulků")
	Me1-3	Zvěrkovice
II/137	Me4-2	Slapy bypass + repair of road between Slapy and Malšice
	Me4-4	Malšice bypass
	Me4-5	Measure in Všechlapy near Malšice
	Me4-6	Bechyňská Smoleč bypass
	Me4-7	Measure in Sudoměřice u Bechyně
	Me4-8	Reconstruction of intersection with road II/135 near Sudoměřice u Bechyně
	Me4-9	Diversion of road II/137 near Březnice
II/138	Me5-2	Road widening between Albrechtice and Všeteč
	Me5-3	Measure in Všeteč
	Me5-4	Road widening between Všeteč and Temelín
	Me5-5	Southwestern bypass of Temelín
II/147	Me2-1	Žimutice bypass
	Me2-2	Bečice bypass
	Me2-3	Bzí bypass
	Me2-4	Modification of class II road in a section of D3 near Bošilec - Dolní Bukovsko
	Me2-5	II/147 repair
	Me7-1	Dolní Bukovsko bypass
II/159	Me3-0	Modification of intersection of I/20 and II/159 near Nový Dvůr
	Me3-1	Tálín bypass
	Me3-3	Paseky bypass
	Op3-4	Albrechtice nad Vltavou bypass
	Me3-5	II/159 repair
III/1411; III/1413	Me6-1	Measure in Všemyslice
Týn nad Vltavou	Týn nad Vltavou	Týn nad Vltavou
	Me1-1a	Roundabout on road II/105 - II/159
	Me1-1b	Pavement along road II/159
	Op1-1c	Noise barrier at "Pod lesem"
	Me1-1d	Pavement from bus station to Havlíčkova Street
	Me1-1e	Escape route from Hlinky housing estate to Veselská Street
	Me1-1h	Roundabout on II/159 and II/147
	Me1-1i	Window replacement (acc. to noise study)

In connection with the planning of construction organisation and precise identification of transport routes, arrangements will be made, before and during the construction but always before use, for the construction of such technical measures on affected roads at a regional and supraregional level (bypasses, diversions, window replacements, safe pedestrian crossings, fixing spot road faults) that will minimise the negative impacts of increased traffic volumes on all constituents of the environment including the human constituent (impacts on public health and inhabitants), including measures on transport routes that were not planned to be used at the time of the preparation of EIA documentation.

The transport of oversized and heavy components to the Temelín site was verified in feasibility studies, which did not result in any significant demands on the modification of existing roads and transport infrastructure. They only include directional and local modifications, partial expansion and repairs of existing transport infrastructure. Considering the assumed quantity of oversized components to be transported (a few pieces) and the nature of expected modifications to the existing transport infrastructure, the impacts can be considered insignificant.

As for railway transport, which is used at about 63% today (the capacity margin is 15 trains per day), the impact of the utilisation of railway transport during construction can be considered insignificant. It is recommended to maximise the use of this method of transport.

D.I.10.4. Impacts in the shutdown period

Transport in the shutdown period is expected to follow the same transport pattern as in the operational/construction period. Expected impacts will thus not exceed the limits described under operation/construction.

D.I.11. Other environmental impacts

D.I.11.1. Impacts resulting from inactive waste management

The Temelín Power Plant implements an inactive waste management system, which is in compliance with applicable law. The waste management system prefers waste generation prevention, or waste utilisation, to waste disposal. Generated waste is collected and sorted at the place of generation, then moved to collection points and, depending on its type, either disposed of in the power plant's own facilities (deposited at the plant's own dumping ground, Site 6 - Temelínec) or handed over to specialised companies for disposal or recovery.

This system will be preserved after the NNPP project is implemented, making adjustments for any changes in the law.

Dumping ground capacities at Site 6 - Temelínec are sufficient for the construction period (after an increase in the deposition capacity of dumping ground S-IO). The capacity of waste dumping ground S-OO3 is sufficient for the operation of NPP Temelín 1, 2, 3, 4; the capacity of the inactive sludge lagoon is also sufficient until the end of 2080.

Waste generation during the construction period will be kept to a minimum. The vast majority of building waste will consist of inert materials recyclable for further use, either at the construction site or by other builders. Non-recyclable waste will be deposited at the expanded existing dump S-IO at site 6 - Temelínec. Other construction waste will be handled similarly to waste from plant operation. Category S-OO3 construction waste (communal waste) will be sorted out for recycling and then deposited at the S-OO3 dumping ground at site 6 - Temelínec; hazardous waste (S-NO) from construction will be handed over to authorised persons for depositing at a dumping site of the appropriate category.

The following figure shows the location of individual dumping grounds at site 6 - Temelínec.

Figure D.I.19: Site 6 - Temelínec

LOKALITA 6	LOCALITY 6
ODKALIŠTĚ NEAKTIVNÍCH KALŮ	DESLUDGING LAGOON OF NON-ACTIVE SLUDGE
SKLÁDKA S-10	TIP S-10
KONTROLNÍ JÍMKA SKLÁDKY S-10	TIP S-10 INSPECTION PIT
KONTROLNÍ JÍMKA SKLÁDKY S-003	TIP S-003 INSPECTION PIT
SKLÁDKA S-003	TIP S-003
AREÁL ETE	TEMELÍN PP COMPLEX

The above information indicates that waste management can be handled in compliance with applicable law.

D.I.11.2. Impacts resulting from radioactive waste management

Radioactive waste and spent nuclear fuel[1] are managed in the Czech Republic in compliance with the strategy approved by the Czech Government on 15 May 2002 (Government Resolution no. 487/2002) and in compliance with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

The safe deposition of radioactive waste (pursuant to Act no. 18/1997 Coll., the Atomic Act) is guaranteed by the state. The Radioactive Waste Repository Administration (RAWRA), an organisational component of the State, is established for this purpose. The activities of the RAWRA are defined in section 26 (3) of Act no. 18/1997 Coll., the Atomic Act, and include (among other things) the preparation, construction, commissioning, operation and decommissioning of nuclear waste repositories and monitoring of their impact on the surroundings.

[1] Spent/irradiated nuclear fuel is not waste. Within the meaning of Section 24 (3) of Act no. 18/1997 Coll., on peaceful utilisation of nuclear energy and ionising radiation (Atomic Act), until spent or irradiated nuclear fuel is declared radioactive waste by the originator or the Office, its handling must meet the requirements for radioactive waste in addition to requirements imposed by other sections of the Act. The owner of spent or irradiated fuel must handle it in a manner that will not make its further processing more difficult.

Low- and medium-level waste originating from nuclear power generation in the Czech Republic is kept at a RAWRA repository in Dukovany. The repository is located at the site of the Dukovany Nuclear Power Plant in the cadastral area of Rouchovany in the district of Třebíč. It has been in permanent operation since 1995. The total repository capacity is sufficient for depositing all low- and medium-level waste from the nuclear power plants in the Czech Republic.

The basic national strategy for spent fuel management in the Czech Republic is long-term storage and subsequent reposition in a deep underground repository.

Spent fuel from the nuclear power plants in the Czech Republic is stored using the “dry” method in dual-purpose transport and storage packaging in separate repositories at the sites of the nuclear power plant. The storage does not produce any significant impacts on the environment, which was documented both during the assessment of the impact and by long-term operational monitoring of storage facilities in Dukovany and Temelín. An analogous method will be used to store spent nuclear fuel from the NNPP project.

The preparation of a deep underground repository is carried out by the state, represented by the state organisation RAWRA.

The above information indicates that radioactive waste management and spent fuel management can be handled in compliance with applicable law and the applicable national strategy.

D.II. COMPREHENSIVE DESCRIPTION OF THE PROJECT’S ENVIRONMENTAL IMPACTS IN TERMS OF THEIR EXTENT AND SIGNIFICANCE AND POSSIBLE CROSS-BORDER IMPACTS

The project’s impacts on the environment are overall insignificant in all assessed categories (impacts on the population, air and climate, noise and other physical or biological characteristics, surface and ground water, rock environment and natural resources, fauna, flora and ecosystems, landscape, tangible assets and cultural heritage, transport and other infrastructure, or any other impacts). There are no findings indicating that applicable legal limits should be exceeded or (if no limits are specified) that its influence should be unacceptable.

Potential negative impacts are acceptable in all categories, even if the contributory impacts of existing activities in the area are included (especially the operation of the existing Temelín Power Plant); they are well in the range of permissible or acceptable values.

The affected area, i.e. (pursuant to Act no. 100/2001 Coll., on environmental impact assessment) the area “the environment and population of which might be seriously affected by project implementation”, is limited to the project site and its immediate surroundings. There is no serious impact on the environment and/or population on a broader scale.

As also results from the above summary, the affected area does not cover the territory of any other countries; there are no cross-border impacts of any significant extent.

The above conclusions are valid on condition that an adequate level of nuclear safety is ensured for the project. Since the project concerns a nuclear facility, this specifically means to:

- prevent uncontrollable development of fission reaction,
- prevent unacceptable leaks of radioactive substances,
- prevent unacceptable leaks of ionising radiation,
- reduce the consequences of accidents.

Information about compliance with these requirements is included in the following chapter of this document.

D.III. DESCRIPTION OF ENVIRONMENTAL RISKS DURING POSSIBLE ACCIDENTS AND NON-STANDARD SITUATIONS

D.III.1. Radiological risks

This chapter deals with radiological risks associated with the operation of the nuclear power plant. For this purpose, each of the two categories of accident conditions, i.e. design basis accidents and severe accidents, was modelled both for the territory of the Czech Republic and for the nearest neighbouring countries. The conclusion contains comments on assessment results and their impacts on the delimitation of the emergency planning zone around the power plant.

D.III.1.1. Normal and abnormal operation

During normal and abnormal operation, the dose optimisation limit for total radioactive discharges pursuant to Decree no. 307/2002 Coll., as amended, will not be exceeded in the critical group (representative individuals). The expected dose value associated with normal and abnormal operation is described in Chapter D.I.3.3. Impacts of ionising radiation (page 407 in this document).

D.III.1.2. Accident conditions

The assessment of accident conditions is divided into the assessment of “design basis accidents” and the assessment of “severe accidents”. These two types of accident conditions differ not only in their probability of occurrence but also in the course of events and severity.

The potential severity of accident radiological consequences is related to the activity level of radioactive fission products in the reactor and to the scope of damage to barriers preventing leakage of radioactive substances into the environment. Fission products are present in primary circuit coolant, under the cladding of fuel rods and especially in the fuel structure of a reactor core itself. The total activity of fission products in the core during the operation of a reactor at power depends primarily on the quantity of fuel in the core and its burn-up at the time of the accident, and is in the order of magnitude of multiples of 10^{20} Bq. The only fission products with significant occurrence in coolant are isotopes of noble gases, iodine and caesium, but their activity in coolant is at levels a hundred thousand times lower than in fuel. Other relevant isotopes such as Sr, Te, Ru, La, Ce, Ba, etc. are present in insignificant quantities in coolant. The activity of isotopes in the gas gap under fuel rod cladding represents fractions of percent of fuel activity. The severity of radiological consequences thus differs considerably depending on whether there was just loss of integrity of the cooling circuit or damage to fuel rod cladding or even a fuel melt.

Design basis accidents involve at most a release of radioactive substances from primary circuit coolant and, to a limited extent, from gas gaps under fuel rod cladding. It is obvious that such activity released into the containment represents a negligible quantity in comparison with the total inventory of radioactive material contained in the core. Consequently, possible impacts of design basis accidents are very low in comparison with those of severe accidents. They are classified as level 3 and 4 on the INES scale (see below).

Severe accidents involve extensive damage to the reactor core. For a pressurised water reactor, this means accidents during which the nuclear fuel melts so that radioactive substances may be released from the core to the containment and subsequently off-site. Such accidents are classified as level 5 to 7 on the international INES scale.

Requirements applied to new power plant projects differ significantly from previous projects by more extensive utilisation of defence in depth both by preventing severe accidents and by managing their consequences. A severe accident may only result from multiple failures of plant systems or personnel at various independent levels of defence in depth, e.g. from loss of primary coolant and subsequent long-term loss of external and then internal power supplies. New-generation nuclear power plants are equipped with special systems designed to handle even such extremely unlikely accidents. New nuclear power plants are designed to have a severe accident probability less than 10^{-5}/reactor.year.

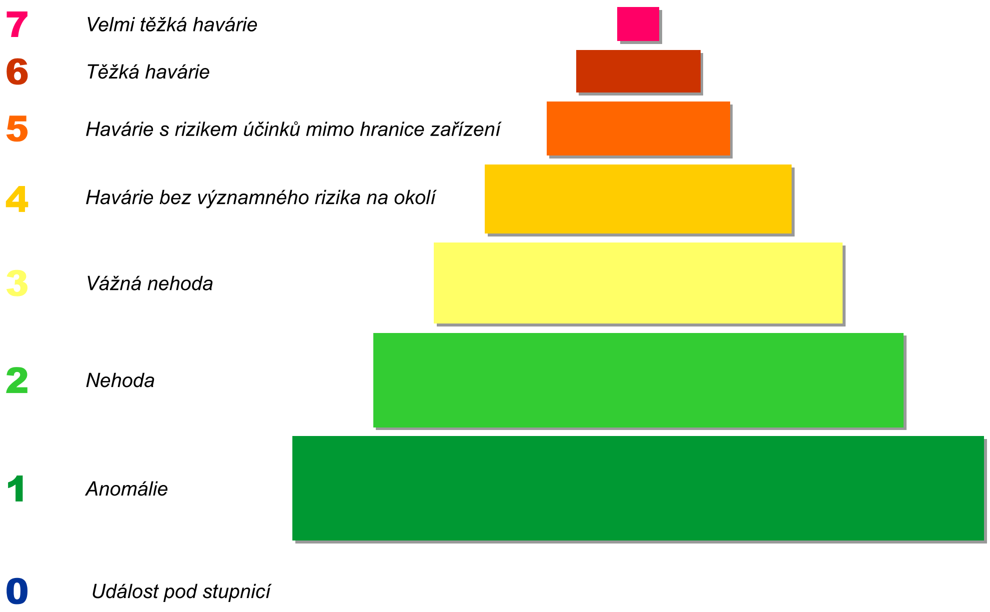
Even if such a highly unlikely severe accident occurs and the actual reactor is damaged, a significant quantity of radioactive substances can be released to the environment only if such substances pass through another barrier - the containment. The containment is designed and fitted with special systems to prevent the loss of its integrity even during severe accidents, e.g. by melted fuel interacting with concrete, hydrogen burning or exploding, the effect of flying objects, overpressure, etc. The core is cooled and heat is removed from the containment so that the containment remains intact not only during the accident but also for a long time afterwards. A generally recognised international criterion restricting significant releases of radioactive substances into the environment is a probability of occurrence of such an event less than once in 1,000,000 years, i.e. 10^{-6}/reactor.year, which is met by the types of reactors under consideration with at least a tenfold margin.

The possible radiological consequences of a severe accident are restricted by safety requirements for new nuclear power plants so that a release of radioactive substances may neither cause significant irradiation of or health damage to the population in the immediate vicinity of a nuclear power plant nor result in establishing long-term, large-scale restrictions in the control of food chains or the use of land and water bodies. The restriction of radiological consequences should result in a situation in which even a severe accident will require neither evacuation in the nearest residential zone around the plant or outside the inner part of the emergency planning zone nor any other urgent protective measures (sheltering, iodine prophylaxis) outside the plant's emergency planning zones.

D.III.1.2.1. Event characteristics according to the international classification scale

The International Nuclear Event Scale (INES) was introduced in March 1990 jointly by the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA). Its primary purpose is to facilitate communication and understanding between the nuclear community, the media and the public on the safety significance of events occurring at nuclear installations as well as any event associated with radioactive material and/or radiation, including the transport of radioactive materials.

Figure D.III.1: INES scale for assessing nuclear events



Velmi těžká havárie	*Very heavy accident*
Těžká havárie	*Heavy accident*
Havárie s rizikem účinků mimo hranice zařízení	*Accident with risks outside of facility's boundaries*
Havárie bez významného rizika na okolí	*Accident with no significant effect on surroundings*
Vážná nehoda	*Serious incident*
Nehoda	*Incident*
Anomálie	*Anomaly*
Událost pod stupnicí	*Event below scale*

Events are classified on the scale at seven levels: the upper levels (4-7) are termed “accidents” and the lower levels (1-3) “incidents”. Events which have no safety significance are classified below scale at level 0 and are termed “deviations”. Events which have no safety relevance are termed “out of scale”.

D.III.1.2.2. Description of environmental risk

Immediately after a release of radioactive substances from a nuclear installation, the population is threatened by a passing cloud of released radioactive gases and aerosols. The cloud is a source of both external and internal exposure, which results from inhaling radioactive substances.

As the cloud passes, radioactive aerosols fall out and contaminate the terrain. The level of terrain contamination depends highly on whether it rained in the area when the cloud passed over it. Even after the cloud passes, earth surface contamination causes external exposure and internal exposure by inhaling contaminated dust and can represent long-term damage to the environment, affecting to various extents the entire population, flora and fauna. What is significant in terms of health risk to the population is the transport of activity in food chains, resulting in internal exposure by ingestion - i.e. primarily by eating contaminated agricultural products.

Risks associated with the possible consequences of a radiological accident (i.e. an event that results in an impermissible release of radioactive substances into the environment) can be assessed based on the scope of necessary measures to protect the threatened population and the level of contamination of the affected environment.

To limit irradiation of humans and the environment during an radiological emergency, protective measures are introduced. These are:

a) urgent protective measures including sheltering, iodine prophylaxis and evacuation,

b) subsequent protective measures including relocation, control of the consumption of food and water contaminated by radionuclides and control of the use of feedstuffs contaminated by radionuclides.

Protective measures are always taken during radiological accidents if they are justified by a benefit greater than the cost of the measures and the damage they cause, and should be optimised in terms of form, scope and duration to provide as much benefit as reasonably achievable.

An urgent protective measure is always considered justified if the anticipated exposure of any individual could result in immediate health damage. Therefore, urgent protective measures are taken whenever it is expected that absorbed doses could exceed levels shown in the table below in any individual in less than 2 days.

Table D.III.1: Levels in the excess of which an intervention is expected under any circumstances [Gy]

Organ, tissue	Absorbed dose anticipated or expected to be received in less than two days [Gy]
Whole body	1[1]
Lungs	6
Skin	3
Thyroid gland	5
Eye lens	2
Gonads	1

[1] The possibility of immediate damage to a foetus at anticipated doses higher than about 0.1 Gy must be taken into account when justifying and optimising the current intervention level for urgent measures

Basic guidance in making decisions on the establishment of protective measures is provided by guidance values, which reflect the present level of knowledge and internationally gathered experience with when a given protective measure can be expected to have a benefit greater than loss. For individual radiological activities or sources of ionising radiation that pose a risk of radiological emergency, these reference intervention values, specific for a given radiological activity or source, are set down in emergency plans on the basis of data specific for each given case, using optimisation of radiological protection.

Specific data for the specification of intervention levels means e.g. data characterising settlements and infrastructure around a source of ionising radiation and qualifying expected collective effective doses and protective measure feasibility, in particular the presence of specific population groups, traffic situations, etc.

When making a decision on taking protective measures in an radiological emergency, account must be taken in particular of whether the current situation differs significantly from the conditions that were applied to the specification of intervention levels. If a radiological emergency occurs simultaneously with an emergency resulting from another accident, such as the release of harmful chemical substances, or a natural disaster, consideration must also be given to whether taking a “radiological” protective measure will not increase the damage caused by such other accidents or disasters, to an extent greater than the benefit of exposure reduction.

Table D.III.2: Ranges of guidance values of intervention levels for introduction of urgent and subsequent protective measures based on Czech legislation and international recommendations

Guidance values for protective measures pursuant to Decree no. 307/2002 Coll. and ICRP recommendations			
	Range of effective doses	More precise guidance	Range of equivalent doses
Urgent protective measures			
Sheltering and iodine prophylaxis	5-50 mSv/2 days	Averted effective dose 10 mSv/2 days	50-500 mSv/2 days
Iodine prophylaxis	5-50 mSv	Averted committed effective dose 100 mSv	50-500 mSv
Evacuation	50-500 mSv/7 days	Averted effective dose 100 mSv/7 days	500-5,000 mSv/7 days
Subsequent protective measures			
Control of food, water, feedstuffs contaminated by radionuclides	5-50 mSv/year	-	50-500 mSv/year
Initiation of temporary relocation	-	Averted effective dose 30 mSv/1 month	-
Termination of temporary relocation	-	Expected effective dose 10 mSv/1 month	
Permanent relocation	50-500 mSv/year	Expected lifetime effective dose	Not specified

		1,000 mSv	

D.III.1.3. Accident assessment methodology

The assessment methodology consists of steps described in this section - determining the source term and then calculating the spread and environmental impact of radioactive substances. The methodology for calculating the source term is described in Chapter D.III.1.3.1, the methodology for calculating environmental impacts in Chapter D.III.1.4.

D.III.1.3.1. Source term

The *source term* means the quantity, isotopic composition and time distribution of radioactive substances released from the containment into the environment.

The source term significantly determines the possible radiological consequences of such a nuclear plant accident (in addition to the current weather conditions, season of the year, demography in the vicinity of the source, etc.). Source term properties are profoundly dependent on specific design features, such as containment tightness and layout, the chemical and physical form of radionuclides (especially volatility and radioactive half-life), the sedimentation and coagulation of produced aerosols, the operation of systems washing fission products out of the containment atmosphere, the capacity and efficiency of filtration systems and the development of the accident as such over time.

Each radiological accident scenario analysed is characterised by a specific source term whose parameters are given by the amount of damage to a certain operational system, the inventory radioactive substances present in the system and the condition of individual barriers.

The conservative approach, generally accepted for safety analyses, requires that the source term be determined so that radiological consequences corresponding to the source term are worse, with a sufficient margin, than those that will be implied, taking account of uncertainty levels, from the results of subsequent safety analyses of the specific winning PWR unit in the selection procedure. Therefore, the estimate of radiological consequences for the purposes of environmental impact assessment can be more general, as long as it is made with a sufficient margin and a detailed assessment of the specific design will be performed in a Preliminary Safety Report.

D.III.1.3.1.1. Qualitative determination

The results of international accident studies evaluating the relative share of radionuclides in radiological consequences indicate that the following main groups of fission products must be taken into account:

- noble gases (especially Xe-133 with a half-life of 5.2 days) - they are the source of external exposure of individuals from a cloud of spreading radioactive substances; however, it must be said that this exposure is not that significant in terms of long-term radiological consequences,
- iodine (especially I-131 with a half-life of 8.0 days) - it gets into the organism by breathing, deposits mainly in the thyroid gland and its share is significant in terms of short-term and medium-term accident consequences unless its deposition is blocked by the timely administration of inactive iodine,
- caesium (especially Cs-137 with a half-life of 30 years) - it usually represents the main source of external and internal exposure of individuals affected by an accident in the long term, due to the contamination of earth surface and other constituents of the environment (water, flora) and in the end due to the contamination of individual food chain commodities,
- other fission products (especially Te, Sr, Ru, La, Ce, Ba) and actinides - they are released from melted fuel in lesser quantities; they are negligible in design basis accidents and even in severe accidents they are less significant than caesium; nevertheless, their share in the irradiation of individuals and environmental and food chain constituents must be taken into account, especially during the first year after an accident.

As results from the above, it is important for a comprehensive assessment of the immediate threat to individuals in the vicinity of a nuclear installation to include representatives of all radionuclide groups, which are: Xe-133, I-131, Cs-137, Te-131m, Sr-90, Ru-103, La-140, Ce-141 and Ba-140. Calculations performed with this source term will allow assessing the radiological consequences of potential accidents for the source and site in question.

To characterise the environmental risk in terms of a long-term ecological load on the environment, specifically in the event of design basis accidents, a simplified source term can be used, consisting just of these representative radionuclides: I-131, Cs-137, and possibly also Sr-90.

In this case, the source term is based on the yield of fission and activation products of nuclear reactions in fuel with UO_2 enriched with U-235, which is used for power generation in all PWR reactors under consideration. The representation and mutual ratios of individual significant radionuclides are thus given by objective physical laws and do not depend on a specific reactor design or vendor. It is therefore possible, even before the selection procedure is finalised, to specify groups of radionuclides whose representation in the source term will be determining for safety analyses and select such representatives among them that will allow the resulting simplified source term to assess the radiological consequences of the entire inventory of radionuclides released into the environment during an accident with sufficient accuracy.

The release of fission products from melted fuel during a severe accident depends primarily on their chemical and physical form. It is generally assumed that at a high melted fuel temperature, up to 75-100% of noble gases, iodine and caesium are released from the fuel into the containment (for design basis accidents, it is tenths to units of a percent). The amount of release of other radionuclides from fuel to the containment represents tenths of a percent up to tens of a percent. Only a fraction of fuel fission product activity is released into the environment with a severe accident and preserved containment integrity, depending on a number of factors (technical, design).

D.III.1.3.1.2. Quantitative determination

The total quantity of radioactive substances that could be released into the environment is given by the physical properties of individual barriers and their current condition at the time of an event.

The quantitative determination of the source term is based on the assumption that containment integrity will be maintained but respects permissible design leakage and containment bypass. The assumption is justified by the fact that the containment of all units under consideration is equipped with special systems so that there is no loss of integrity due to any relevant phenomenon even during severe accidents. The cooling of a damaged core and heat removal from the containment are ensured so that the containment remains intact during an accident and for a long time afterwards.

Although in reality the release of radionuclides from fuel to the containment atmosphere can last for up to tens of hours, it is assumed for the purposes of the calculation that the whole quantity will be released at once as soon as an accident occurs. It is also pessimistically assumed that the whole quantity of radionuclides will be released from the containment to the environment at a constant rate within 6 hours of an accident, even though in reality such release could last for at least several days.

A source term representing long-term environmental impacts, containing the I-131 and Cs-137 representatives, was chosen for a design basis accident. This source term[1] is based on the European requirements for Generation III nuclear power plants (European Utilities Requirements for Light Water Reactors).

Table D.III.3: Source term table for design basis accident

High-altitude release		Ground-level release	
Radionuclide	TBq	Radionuclide	TBq
I-131	150	I-131	10
Cs-137	20	Cs-137	1.5

The severe accident source term is constructed using the fraction of radionuclide inventory released from damaged fuel into the containment according to the U.S. Nuclear Regulatory Commission document NUREG-1465.

Due to the current status of the selection process, the ratio of radionuclides released from the containment to the quantity of radionuclides contained in the containment (determined in the above-mentioned manner) was determined using the requirements imposed on potential vendors. In these requirements, limit values were specified for Xe-133, I-131 and Cs-137.

[1] In EUR terminology, this is an accident with a probability getting near to 10^{-6}/year.

Radionuclide values released into the environment were proposed conservatively, using the above-mentioned method, as follows:

Table D.III.4: Source term table for severe accidents

Radionuclide	TBq
Xe-133	770,000
I-131	1,000
Cs-137	30

The values of other fission products were derived from the Cs-137 limit value directly proportional to their relative concentration to Cs-137 in the containment atmosphere. The adequacy of this method was verified on available source terms from comparable projects.

D.III.1.4. Description of the calculation software

Estimates of the radiological consequences of severe accidents are based on calculations made in HAVAR-RP. This software respects the local geographical circumstances and allows simulating various weather conditions. It takes account of terrain altitude as well as terrain roughness and local vegetation. These factors can be the cause of effective dose values not decreasing with growing distance from the source at some places, or of the occurrence of local extremes.

D.III.1.4.1. Specification of input parameters

The following input parameters were chosen for the calculation of radiological consequences of accident conditions:

Table D.III.5: Input parameters for the calculation of radiological consequences of accident conditions

Height of release	for design basis accident: 45 m, 100 m for severe accident: 45 m
Distribution of iodine forms	aerosol: 5% organic: 5% elementary: 90%
Release duration	6 hours
Thermal buoyancy	Zero

One of three sets of selected weather conditions was used for each calculation. They were selected so that the modelled scenario had the worst radiological consequences of the three possible variants. Individual variants of weather conditions differ mainly in the selected wind direction, velocity and weather category (and possibly by the amount of precipitation). Weather category is specified as one of the Pasquill stability classes (Pasquill-Gifford notation).

Table D.III.6: Individual variants of weather conditions

Scenario variant	1.	2.	3.
Direction of spread	NE	ESE	SW
Wind velocity [m/s]	5	2	2
Weather category	D	F	F
Amount of precipitation [mm/h]	10	0	0

D.III.1.4.2. Circumstances influencing radiological consequences

The resulting short-term (48-hour, 7-day, 30-day) exposure of an individual consists of contributions from the following exposure pathways:

- cloud exposure,
- inhalation (including resuspension),
- deposition.

The calculation of the level of an individual's exposure in one year also takes account of the ingestion pathway. The consequences of internal exposure due to the annual intake by ingestion are expressed as the value of a 70-year committed dose for a child aged 1-2 at the time of the accident ("1-year effective dose with ingestion"). The "lifelong dose" is calculated similarly, as the sum of doses from external exposure and committed effective doses from intakes over 70 years. The following 4 factors have a crucial effect on the calculation of ingestion exposure consequences for such an individual:

- "consumer basket" - the share of consumed food from local (i.e. contaminated) sources,
- fallout duration,
- the individual's age,
- terrain - affects the rate of dry deposition.

As for the assessment of possible radiological consequences in a certain direction of radionuclide spread, terrain properties are an invariant factor but have a significant effect on the calculation. Terrain variability along a plume route causes local deviations in effective dose values. It is conservatively assumed that the accident will occur in summer and all unharvested crops will be directly affected. The choice of the age of the representative individual for which the resulting effective dose (committed effective dose) is assessed is easy, the least favourable values are achieved for a child aged 1-2 at the time of the accident.

For calculation variant 1, with a NE direction of spread (Týn nad Vltavou), the food/consumer basket (i.e. the amount and types of food a given individual consumes during a given period) is derived from statistical data in the Czech Republic. The assessment of impacts on the border in calculation variants 2 and 3 with ESE and SW directions (Austria, Germany) uses a very conservative assumption of consuming all food exclusively from local sources - a "farm consumer basket".

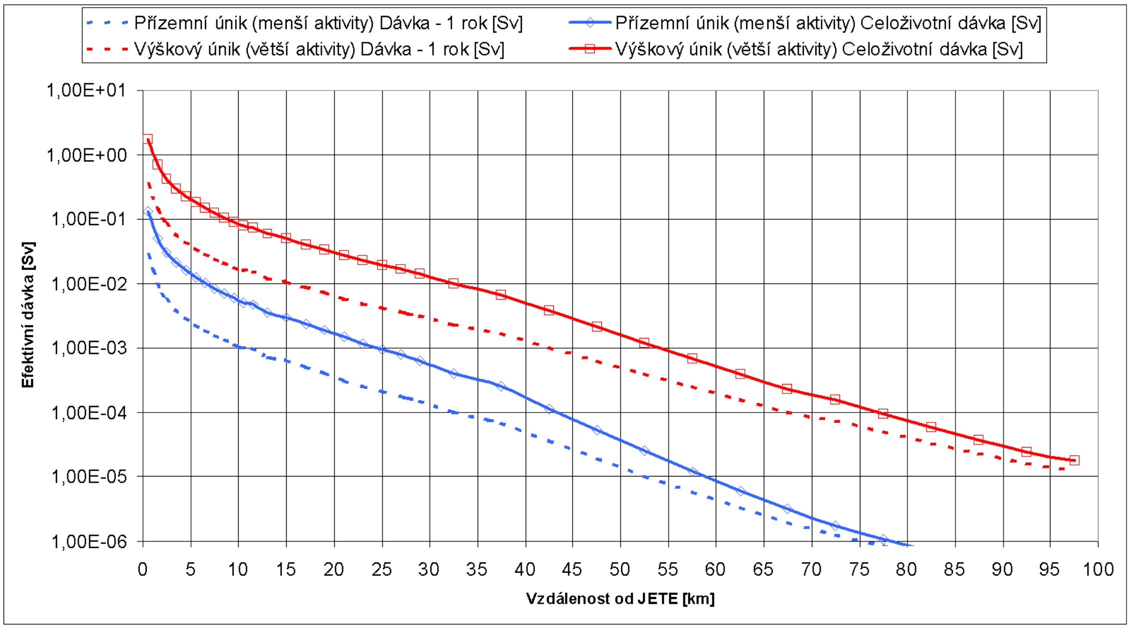
D.III.1.5. Effective doses from internal exposure and committed effective doses from internal exposure

D.III.1.5.1. Design basis accident

The impact of design basis accidents were assessed using weather conditions in variant 1. Two different release height levels were chosen. High-altitude release was modelled for a height of 100 m and ground-level release for 45 m.

The following chart shows calculation results for the 1-year effective dose with ingestion and the lifelong dose.

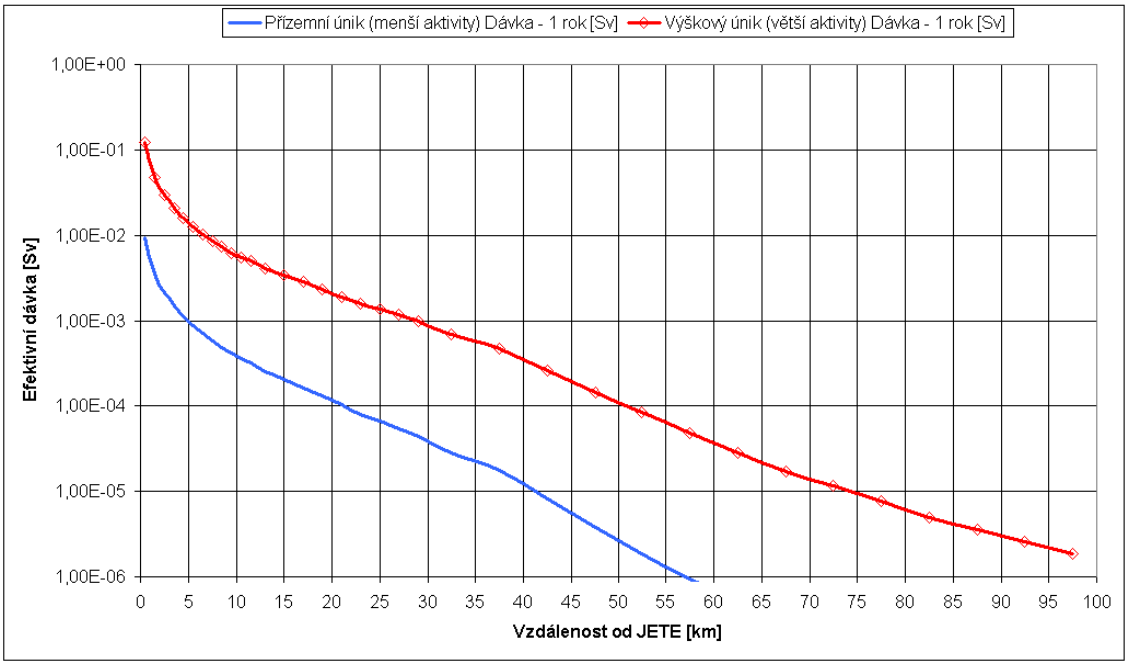
Figure D.III.2: Design basis accident, 1-year effective dose [Sv] and lifelong dose, with ingestion



Efektivní dávka	Effective dose
Vzdálenost of JETE	Distance from TNPP
Přízemní únik (menší aktivity) Dávka – 1 rok	Low altitude escape (minor activity) Dose - 1 year
Přízemní únik (menší aktivity) Celoživozní dávka	Low altitude escape (minor activity) Lifelong dose
Výškový únik (větší aktivity) Dávka – 1 rok	High altitude escape (greater activity) Dose - 1 year
Výškový únik (větší aktivity) Celoživozní dávka	High altitude escape (greater activity) Lifelong dose

The following chart shows calculation results for the 1-year effective dose without ingestion.

Figure D.III.3: Design basis accident, 1-year effective dose [Sv], without ingestion



Efektivní dávka	Effective dose
Vzdálenost of JETE	Distance from TNPP
Přízemní únik (menší aktivity) Dávka – 1 rok	Low altitude escape (minor activity) Dose - 1 year
Výškový únik (větší aktivity) Dávka – 1 rok	Low altitude escape (minor activity) Dose - 1 year

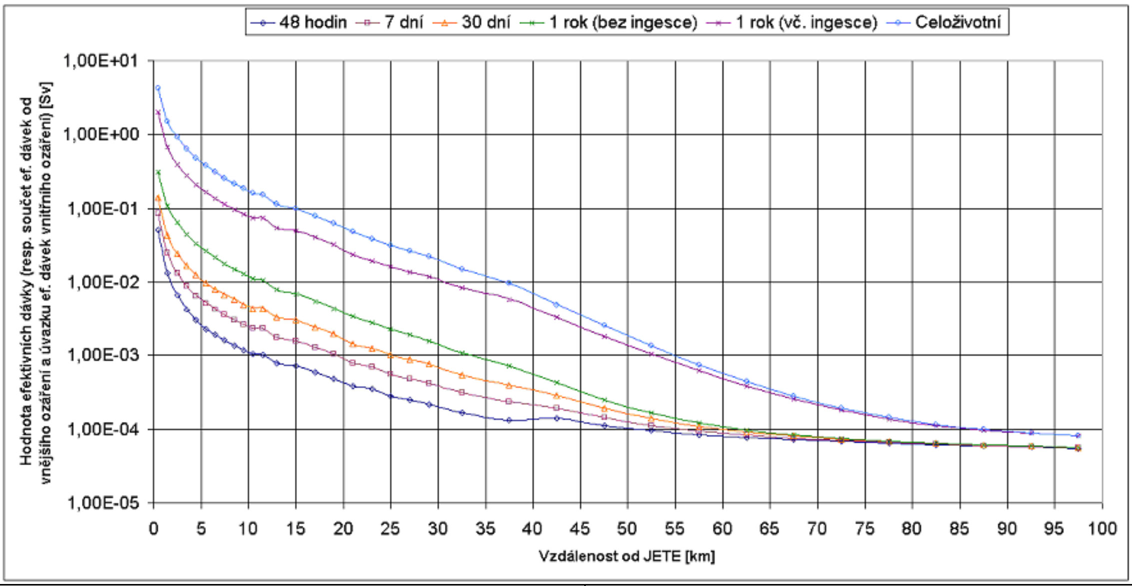
D.III.1.5.2. Severe accident

D.III.1.5.2.1. Impact on the Czech Republic

The impacts of a severe accident on the territory of the Czech Republic were modelled using all three variants of weather conditions; the variant chosen for long-term measures was variant 1, i.e. the direction of spread towards the nearest bigger town, Týn nad Vltavou, and with the presence of precipitation increasing impacts at short distances. The Czech consumer basket was used for the purposes of this.

The chart below shows values of effective doses from external exposure and committed effective doses from internal exposure for the NE direction of spread.

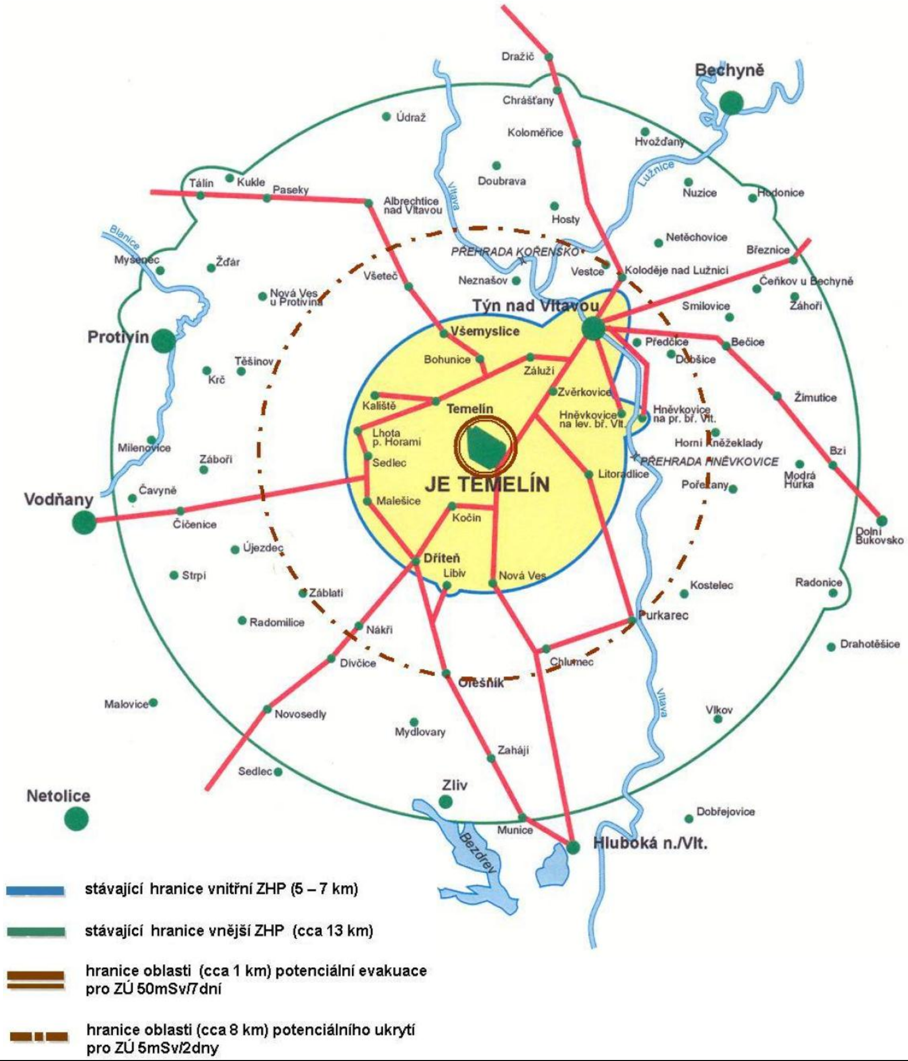
Figure D.III.4: Severe accident, values of effective doses from external exposure and committed effective doses from internal exposure [Sv], NE direction



Hodnota efektivních dávky (resp. součet efektivních dávek od vnějšího ozáření a úvazku ef. dávek vnitřního ozáření)	Effective dose value (or sum of effective doses from external irradiation and committed effective doses of internal irradiation)
Vzdálenost od JETE	Distance from TNPP
48 hodin	48 hours
7 dní	7 days
30 dní	30 days
1 rok (bez ingesce)	1 year (excluding ingestion)
1 rok (vč. ingesce	1 year (including ingestion)
Celoživotní	Lifelong

To suggest possible impacts on the population, the following figure illustrates zones in which the introduction of urgent protective measures can be expected in the event of a severe accident. Zone sizes were derived from the radiological consequences of the above-mentioned variants of the modelled scenario. The radius of each circular zone for an urgent protective measure was defined as the maximum distance from NPP Temelín at which the lowest guidance value for the measure was exceeded, i.e. an effective dose of 5 mSv in 2 days for sheltering and 50 mSv in 7 days for evacuation.

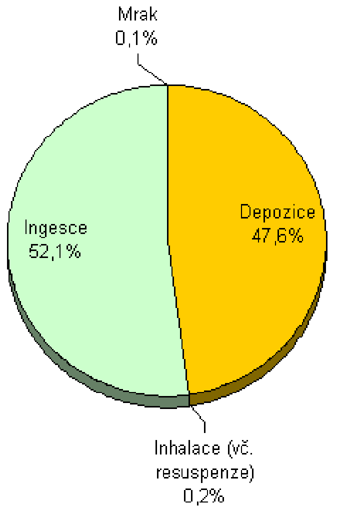
Figure D.III.5: Extent of area for potential introduction of urgent protective measures – sheltering and evacuation (conservatively for SW direction)



JE TEMELÍN	TEMELÍN NPP
Stávající hranice vnitřní ZHP (6 – 7 km)	• Existing internal EPZ boundaries (6-7 km)
Stávající hranice vnější ZHP (cca 13 km)	Existing external EPZ boundaries (approximately 13 km)
Hranice oblasti (cca 1 km) potencionální evakuace pro ZÚ 50mSV/7 dní	Boundary of potential evacuation zone (approximately 1 km) for medical facility 50mSV in 7 days
Hranice oblasti (cca 8 km) potencionální ukrytí pro ZÚ 5mSV/2 dny	Boundary of potential hideout zone for medical facility 5mSV in 2 days

The following chart shows the shares of individual exposure pathways in the lifelong dose. Ingestion is assumed to have a share of about 52% in the total dose. The chart applies to the boundary of the emergency planning zone at approximately 12-14 km.

Figure D.III.6: Share of exposure pathways in the lifelong dose [%] in NE direction at 12-14 km (EPZ boundary)



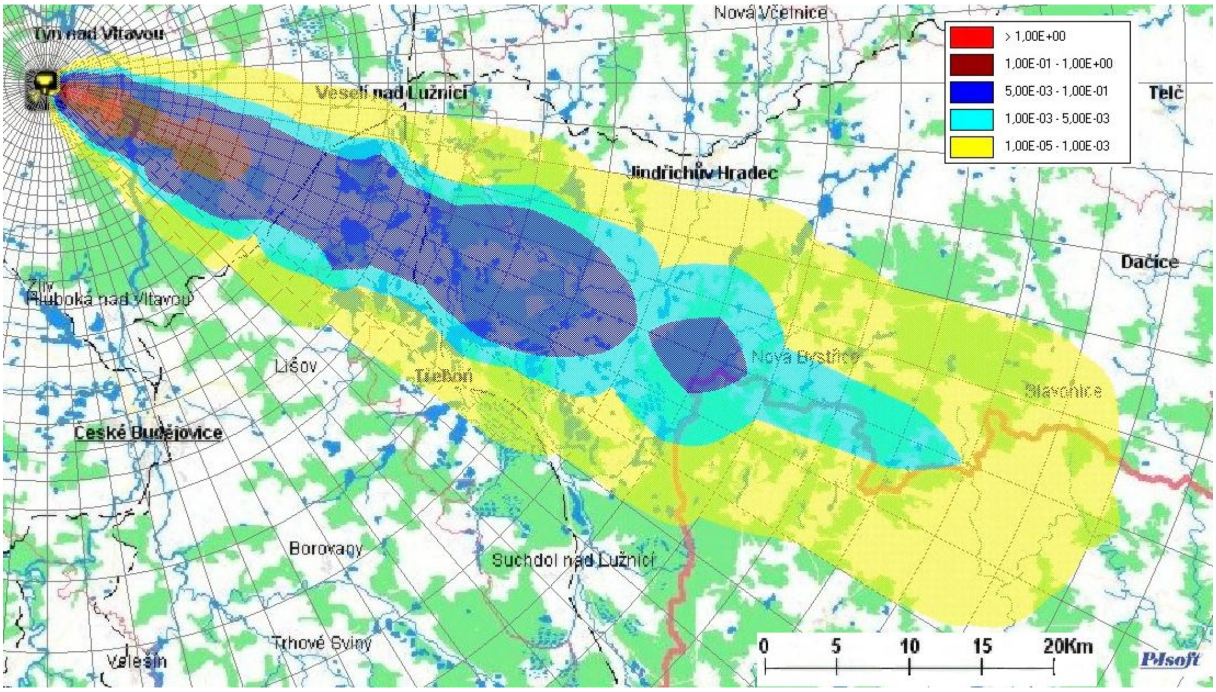
Mrak	Cloud
Depozice	Deposition
Inhalace (vč. resuspenze)	Inhalation (including resuspension)
Ingesce	Ingestion

D.III.1.5.2.2. Impacts on the border

Weather condition variants 2 and 3 were chosen to model the impacts of a severe accident on neighbouring countries. These involve ESE (Austria) and SW (Germany) directions of spread, i.e. directions of the shortest distances to borders with the neighbouring countries. The weather conditions chosen result in higher radiological consequences at greater distances than the conditions chosen for the Czech Republic. A "farm consumer basket" is used.

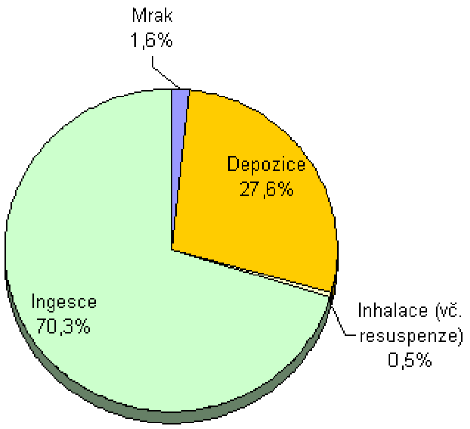
The following map shows the amounts of doses received depending on distance from the power plant in the ESE direction (Austria) for 1 year with ingestion.

Figure D.III.7: Spatial distribution of effective dose values for 1 year [Sv], ESE direction, with ingestion (farm consumer basket)



The following chart shows the shares of individual exposure pathways in the lifelong dose. Ingestion has a share of about 70% in the total dose. The chart applies to the Czech Republic / Austrian border, i.e. a distance of 45-50 km.

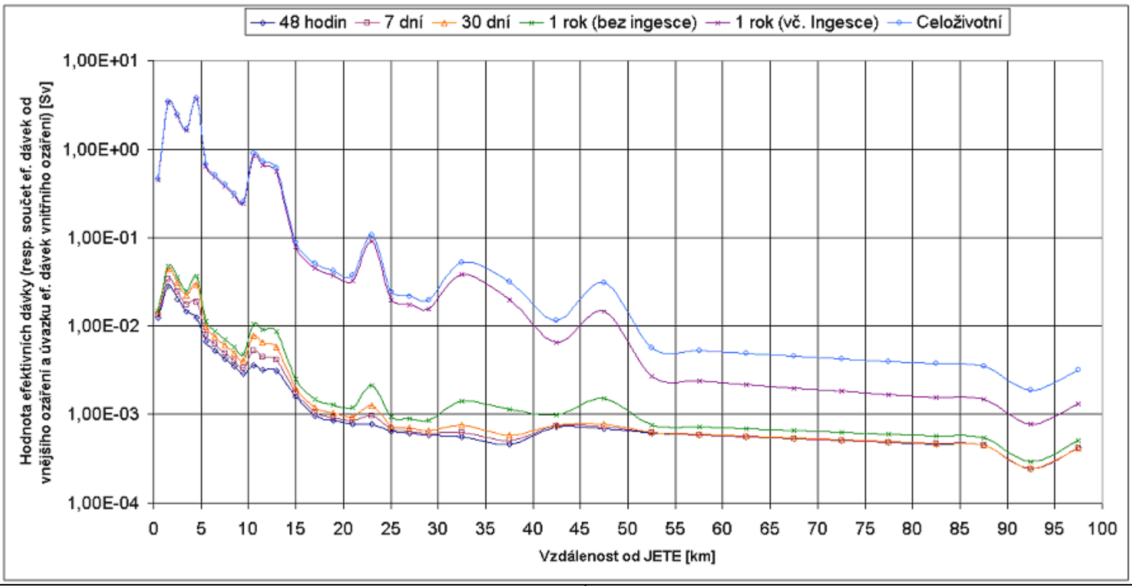
Figure D.III.8: Shares of exposure pathways in lifelong dose [%] at 45-50 km in ESE direction (Czech-Austrian border)



Mrak	Cloud
Depozice	Deposition
Inhalace (vč. resuspenze)	Inhalation (including resuspension)
Ingesce	Ingestion

The following chart shows effective doses and committed effective doses depending on distance from the power plant for 2 and 7 days and 1 year without ingestion, with ingestion and lifelong dose.

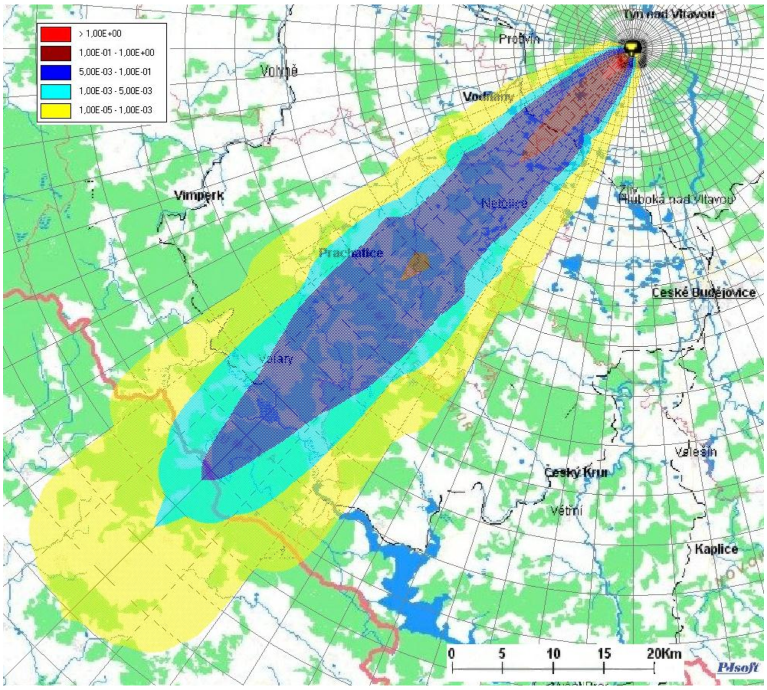
Figure D.III.9: Values of effective doses from external exposure and committed effective doses from internal exposure [Sv], ESE direction



Hodnota efektivních dávky (resp. součet efektivních dávek od vnějšího ozáření a úvazku ef. dávek vnitřního ozáření)	Effective dose value (or sum of effective doses from external irradiation and committed effective doses of internal irradiation)
Vzdálenost od JETE	Distance from TNPP
48 hodin	48 hours
7 dní	7 days
30 dní	30 days
1 rok (bez ingesce)	1 year (excluding ingestion)
1 rok (vč. ingesce	1 year (including ingestion)
Celoživotní	Lifelong

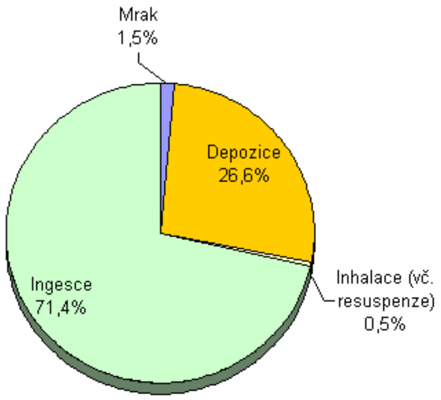
The following map shows the amounts of doses received depending on distance from the power plant in the SW direction (Germany) for 1 year with ingestion.

Figure D.III.10: Spatial distribution of effective dose values for 1 year [Sv], SW direction, with ingestion (farm consumer basket)



The following chart shows the shares of individual exposure pathways in the lifelong dose. Ingestion has a share of about 71% in the total dose. The chart applies to the Czech Republic / German border, i.e. a distance of 45-50 km.

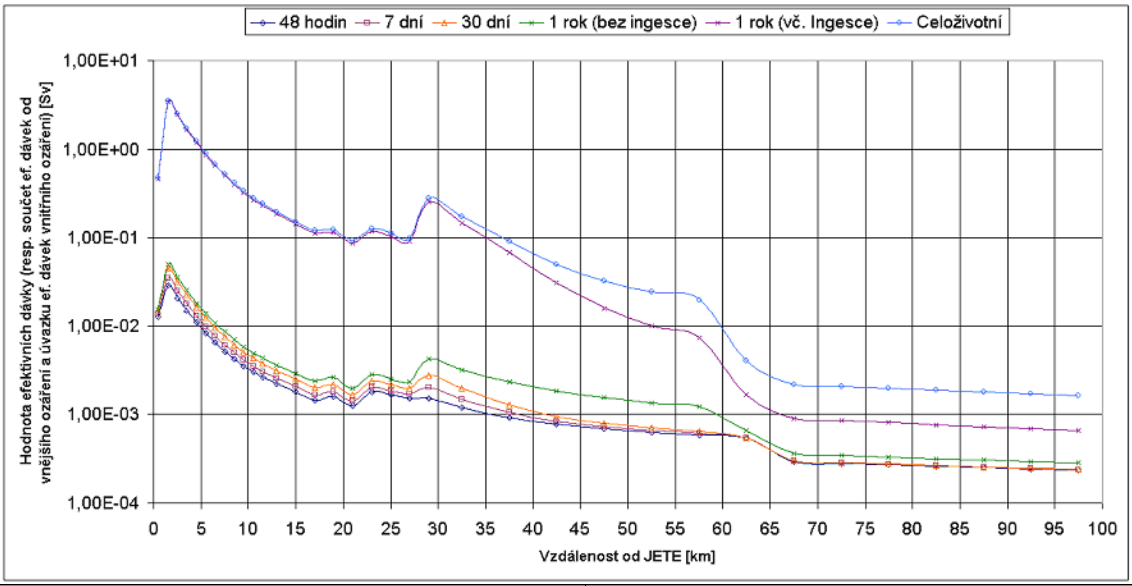
Figure D.III.11: Shares of exposure pathways in lifelong dose [%] at 45-50 km in SW direction (Czech-German border)



Mrak	Cloud
Depozice	Deposition
Inhalace (vč. resuspenze)	Inhalation (including resuspension)
Ingesce	Ingestion

The following chart shows effective doses and committed effective doses depending on distance from the power plant for 2 and 7 days and 1 year with ingestion, without ingestion and lifelong dose (70 years).

Figure D.III.12: Values of effective doses from external exposure and committed effective doses from internal exposure [Sv], SW direction



Hodnota efektivních dávky (resp. součet efektivních dávek od vnějšího ozáření a úvazku ef. dávek vnitřního ozáření)	Effective dose value (or sum of effective doses from external irradiation and committed effective doses of internal irradiation)
Vzdálenost od JETE	Distance from TNPP
48 hodin	48 hours
7 dní	7 days
30 dní	30 days
1 rok (bez ingesce)	1 year (excluding ingestion)
1 rok (vč. ingesce	1 year (including ingestion)
Celoživotní	Lifelong

D.III.1.6. Conclusion

As results from the analyses performed, the radiological consequences of analysed accidents evidence the acceptability of environmental risks.

The results of design basis accident assessment show that with the hypothetical accident chosen, exposure does not necessitate taking any urgent protective measures even in the nearest residential area around NPP Temelín. In addition, it is highly unlikely that it should be necessary to take subsequent protective measures (food chain control) across the borders with neighbouring states.

When the radiological impacts of a severe accident are modelled, guidance values for the introduction of urgent protective measures beyond the existing NPP Temelín emergency planning zones are not exceeded.

As far as subsequent measures in the Czech Republic are concerned, permanent relocation is not assumed for even the nearest residential area around NPP Temelín (the guidance value of a lifelong dose of 1 Sv will not be exceeded). On the conservative assumption that all consumed foodstuffs come from the local agricultural production (Czech consumer basket), it is not possible to exclude food chain distribution and consumption control within 40 km, depending on the direction of radionuclide spread from the source.

The assessment of impacts on the border implies that if a very conservatively chosen farm consumer basket is taken into account, it is not possible to exclude the possibility that the lower guidance value limit for food chain control will be exceeded in a distance of no more than 60 km from the source.

In conclusion, we can sum up that the ingestion exposure pathway contributes more than a half to the total exposure value, as expected. This allows us to infer that introducing short-term restrictions on the consumption of locally grown food would have a significant effect on lowering the dose received.

The actual scope and place of application of subsequent protective measures would be based on the course and development of the accident and real weather conditions and, especially for long-term measures, on comprehensive monitoring of the affected area.

D.III.1.7. Relation to the current emergency planning zone

Proposals for the specification of an emergency planning zone are submitted to the State Office for Nuclear Safety by the holder of a permit to install, build or operate a nuclear installation. The specification of emergency planning zones in the Czech Republic is governed by Government Decree no. 11/1999 Coll. The decree takes account of not only the extent of impacts of a radiological accident (i.e. emergency planning zones are only defined for radiological accidents) but also the probability of a given accident. The decisive value is a declared accident probability of 10^{-7}/year.

Since the Atomic Act defines a radiological accident as a radiological incident whose consequences require urgent measures to protect the population and the environment, submitting a proposal for the specification of an emergency planning zone can be considered in cases when the radiological consequences of accident scenarios will result, with a probability greater than 10^{-7}/year, in releases of radioactive substances in amounts that will require taking urgent protective measures such as sheltering and iodine prophylaxis and evacuation.

The project for new nuclear power plant construction in Temelín anticipates installing at least Generation III PWR generating units with such a safety barrier level that the possible release of radioactive substances into the atmosphere will not require evacuation of the population at a distance greater than 800 m from the reactor building during a radiological accident that can occur with a probability less than 10^{-6}/year. According to the circumstances, such a case will probably require considering at which locations it would be advisable to carry out sheltering and iodine prophylaxis or temporary relocation.

The specific situation in Temelín is such that the nearest residential zone is located well beyond the range of 800 m from reactor buildings, sometimes even at about 3 km. It follows that there is no permanent population in the area where the most serious threat could occur. Moreover, inner and outer emergency planning zones were established in the area due to the operation of NPP 1, 2 and an NPP external emergency plan was prepared for them and has regularly been verified.

The above implies that ČEZ, a.s. as the permit applicant has no reason to submit a proposal for a new specification of the emergency planning zone due to the implementation of the project, which in nature means expanding the TNNP by 2 additional generating units having the expected safety parameters. This conclusion is supported by the performed calculation results of radiological consequences of radioactive releases in the model event of a severe accident.

Data on the new units will be submitted to the author of the external emergency plan within the scope needed for its update at the level of final construction completion before an application for authorisation to operate the new units is filed. The application will include a Pre-operation Safety Report containing safety analyses with radiological consequences of all significant accident scenarios. Reviewing the sufficiency of the analyses, including in relation to the specification of an emergency planning zone, will be within the remit of the State Office for Nuclear Safety.

D.III.1.8. Radiological risks in the preparation and implementation period

Building and construction activities in the project preparation and implementation period do not have the nature of radiological activities. It cannot be excluded that ionising radiation sources defined as simple or perhaps significant sources by the Atomic Act (e.g. non-destructive testing instruments) will be used, always in compliance with the conditions of their design approval and authorisation for use. Depending on the type of instruments used, radiological risks in the construction preparation and execution period may correspond to a relevant category of workplaces with ionising radiation sources.

The nuclear safety of the plant's existing generating units will not be affected by the building and construction work.

D.III.1.9. Radiological risks in the shutdown period

During the shutdown, the first stage of decommissioning will involve shutting down the reactor and removing fuel to a spent fuel pool. Systems will be gradually cooled down, depressurised, desiccated and decontaminated (for more information, refer to Chapter B.I.6.7. Shutdown data, page 179 of this document), which will reduce the sources of potential risk in comparison with the operational period. The activities performed during the shutdown will be performed, in terms of assuring the level of nuclear safety, radiation protection, emergency preparedness and physical protection, in accordance with authorisation valid/applicable at that time pursuant to the Atomic Act so that environmental risks will not increase in comparison with previous normal operation; rather, the risks will be significantly lower.

D.III.2. Non-radiological risks

D.III.2.1. Non-radiological risks in the operational period

The operation of the power plant after extension does not represent a risk factor for the possibility of occurrence of incidents that could have significant negative consequences for the environment and the population.

In connection with the operation, it is not possible to exclude some emergencies accompanied by release of polluted wastewater (due to sewerage leakage or a failure of the oiled water treatment plant), release of stored substances (chemicals, fuels, lubricants and heat-carrying agents, cleaning agents, etc.) from storage tanks or pipe bridges or during transport. It is also not possible to completely exclude the possibility that the above-mentioned media or other materials will catch fire.

The above risks of emergency have a low level of probability. Therefore, no special preventive or eliminative measures are required in addition to those that are usual or required by applicable building, safety, fire-prevention, traffic and other regulations. In addition, good technical practice is assumed to be observed during plant operation. Clean-up means intended for the removal of possible leakage of fuels or other harmful substances are and will be available at the site and in the relevant buildings. The power plant has a system that allows evaluating such leakage as soon as it occurs, before it spreads to the broader surroundings.

Consequences of such events can be handled by standard means. If an accident occurs on paved surfaces, part will be cleaned in situ. A leak into a storm sewer will be handled by the system of safety reservoirs, which are adapted to this.

On unpaved surfaces, there is a potential risk of seepage into the shallow aquifer. Such a situation must be handled immediately by excavating the contaminated soil; possible seepage can be handled by pumping ground water from monitoring or drain wells.

Subsequent measures will depend on the scenario of the event. When a leak of hazardous substances is discovered, e.g. due to transport pipe leakage, an accident at the railway siding or a truck accident, as much pollution as possible must be removed in the non-saturated zone before it gets to the groundwater level and can spread with groundwater to the surroundings. If remedial measures are quick and effective, there is no risk of infiltration into surface water or deterioration of drinking water sources, thanks to the hydrogeological properties of the rock environment and slow groundwater circulation.

The project will meet the requirements of Act no. 59/2006 Coll., on the prevention of serious accidents, as amended.

D.III.2.2. Non-radiological risks in the preparation and implementation period

The operational period risks described above can be applied to the preparation and implementation period as well. Common risks resulting from building and construction work can be handled by means standard for such activities.

D.III.2.3. Non-radiological risks in the shutdown period

Risks in the shutdown period will not exceed those of the preparation and implementation period; they can also be assumed to be manageable using standard available measures.

D.IV. DESCRIPTION OF MEASURES TO PREVENT, ELIMINATE, REDUCE OR COMPENSATE FOR ADVERSE ENVIRONMENTAL IMPACTS

Population and public health

- Strengthen contact with the public to protect the mental well-being of the population in the area. Systematically and fully inform about the plan and its potential impacts on the surroundings throughout the preparation, construction, commissioning and operational periods. Counteract the spreading of groundless and exaggerated information about the dangerousness and harmful effects of operation.
- Keep monitoring the health of the population in the area, make the results available to the public in the plant's information centre.
- Restrict construction traffic to the daytime. After a detailed analysis, consider taking available individual measures in through-traffic towns and villages where construction traffic can have slightly increased disturbing impacts.

Air and climate

- Measures against dust formation will be taken during construction work. Loose material repositories will be minimised during construction. Construction site surface will be sprinkled on dry days to reduce dust formation. In addition, vehicle and road cleaning will be carried out at the exit from the construction site.

Noise and other physical and biological characteristics

- Measures will be taken to meet plant noise limits (at the Temelín Power Plant after expansion as well as the Kočín switchyard).

Surface water and groundwater

- The possibility of reducing consumption of materials containing phosphates in NPP Temelín operations (especially the laundry) will be checked out.
- The wastewater treatment plant will be renovated to meet the needs of NPP Temelín (expanded by the NNPP) so that the technology used can ensure as efficient treatment as possible under economically and technically acceptable conditions.
- All structures and facilities that will store or transport media that must be monitored in terms of their environmental impact will be secured against leakage of hazardous substances.
- The existing monitoring system will be expanded with respect to the location of NNPP structures and new hydrogeological findings from the construction period.
- The construction organisation plan will include preventive and control measures against the release of oil products and other pollutants at the construction site, an emergency plan minimising the consequences of oil product leakage from machinery and storage facilities for fuels, lubricants, machine oils and other non-polar extractives, and regular construction site inspections to detect oil product leakage and follow subsequent procedures in compliance with the emergency plan.

Soil

- Construction (ground) work will be carried out so that the run-off conditions at the site are not adversely affected; excessive earth will be stored so that erosive wash is prevented.

- All construction machinery in use will be in good repair to prevent oil product leakage and excessive exhaust emissions. Vehicles will be parked on paved surfaces. Machinery maintenance (oil exchange, etc.) will not be carried out at the construction site.
- The monitoring and evaluation of the effects of NNPP operation on soil will be included in existing monitoring performed by ČEZ, a.s. for the existing power plant.

Rock environment and natural resources

Since construction, operation and decommissioning will not have any negative impacts on the rock environment or natural resources, no additional technical or compensatory measures are proposed beyond the scope of applicable legislation and design requirements.

Fauna, flora and ecosystems

- If the project is implemented, the conclusions and conditions of the biological assessment will be respected.
- Before construction is started, selected groups of animals will be translocated from the cooling tower construction site to substitute sites, which will be purpose-built in the close vicinity of NPP Temelín at a matching elevation. This will concern especially amphibians and reptiles, which do not have any other chance to leave the construction site. The major part of populations in these groups must be captured and translocated; ideally, all specimens should be captured.
- In addition to amphibians and reptiles, selected mollusc species will be translocated to substitute sites in such quantities that will safely constitute bases for permanent populations at the new sites.
- In order to prevent the introduced populations from being driven out by competitors, the new sites must be free from spontaneously formed large amphibian populations before translocation.
- Animals will not be translocated to previously prepared and built substitute sites if the translocation is so delayed that native amphibian populations form spontaneously at the sites in the meantime.
- The substitute sites will be monitored and evaluated in terms of translocation success.
- The possible occurrence of invasive species will be monitored during construction and after its completion and if such species occur, the investor will arrange for their removal.
- Groundwork related to the maintenance/renovation of the water supply line from the Hněvkovice reservoir will be demarcated with a tape to prevent machinery from entering the more valuable biotopes near the water line corridor. After the completion of groundwork, landscaping will be carried out in order to restore the situation from before the work, including sowing with appropriate mixed seeds and subsequent maintenance (mowing) over at least 5 years, to prevent an invasion of undesirable ruderal and, in particular, geographically non-native species.
- Bird protection requires that not only construction work but especially its preparation (grading, vegetation removal) be carried out outside the nesting season, i.e. outside March to July, to prevent the destruction of nests or nestlings.
- The monitoring of the impact of wastewater discharged from the existing NPP and NNPP will continue, focusing primarily on evaluation of environmental load from radioactive substances and possible intoxication of food chains, including the impact of water warming. Special emphasis must be put on measurement in summer and during periods of low water flow rate in the Vltava.
- During the construction period, building supervision will include environmental supervision, specified by agreement with the nature conservation authority, which will supervise observance of good technical practice by all contractors and respect for sensitive habitats that will be preserved during construction. The environmental supervisor will supervise compliance with conditions defined by the decision on exemptions for implementation and will monitor possible occurrence of invasive species and arrange their suppression in cooperation with the investor.

Landscape

No additional technical or compensatory measures are proposed.

Tangible assets and cultural heritage

Since construction, operation and decommissioning will not have any negative impacts on tangible assets and cultural heritage, no additional technical or compensatory measures are proposed beyond the scope of applicable legislation and design requirements.

Transport and other infrastructures

- The railway will be preferred for transportation related to building and construction work.

Other

No additional technical or compensatory measures are proposed beyond the scope of applicable legislation and design requirements.

D.V. DESCRIPTION OF METHODS USED IN FORECASTING AND INPUT ASSUMPTIONS FOR IMPACT ASSESSMENT

Population and public health

Impacts on the population and public health were assessed using the Health Risk Assessment method based on procedures developed and constantly improved by the US Environmental Protection Agency (EPA) and within the European Union. Those procedures also form the basis of the directives of the Ministry of the Environment of the Czech Republic.

Radiological impacts were assessed using risk coefficients for health detriment based on the recommendations of the International Commission on Radiological Protection (ICRP), which are the basis for the Czech Republic's law on protection from ionising radiation, harmonised with the European Union's legislation.

Non-radiological impacts were assessed using applicable legal limits and risk coefficients based on applicable law and on the recommendations of relevant international organisations.

Input for health impact assessment was relevant studies of radiological and non-radiological impacts.

Other impacts on the population were assessed on the basis of specific studies, literature and supplementary data.

Air and climate

The impact on air quality was assessed using dispersion studies based on the SYMOS 97 methodology.

Climate assessment used results of the CT-PLUME/2 mathematic model with modules for calculating the active phase of a plume, the passive spread of a plume, the dimensions of a visible plume and the impact of a plume on selected meteorological characteristics at ground level.

Noise and other physical and biological characteristics

The description and assessment of impacts on noise conditions in the area were based on studies of Greif-akustika, s.r.o., ACOUSTIC STUDIES, NNPP at the NPP Temelín site, August 2009.

Health limits for noise in the protected outdoor areas of buildings and protected outdoor space are set down by Government Decree no. 148/2006 Coll., on health protection from adverse impacts of noise and vibration.

Surface water and groundwater

Impacts on surface water are assessed on the basis of an expected analogy between NNPP operation and current NPP Temelín operation. Current NPP Temelín operation and affected or affecting watercourses have been monitored in detail on a long-term basis both in direct connection with NPP Temelín and within a state-controlled monitoring network. This allowed forecasting expected impacts with a sufficient level of accuracy. The impacts were forecast with respect to possible climate scenarios up to 2085 (using, in particular, estimates of water volumes in watercourses).

Soil

The assessment of impacts on soils in the area was based on the study Expert Section of EIA Documentation Concerning Soil, AMEC s.r.o. (October 2009); Documents for Elaboration of Chapter B.I.3 Project location and Chapter B.II.1 Soil, Energoprojekt Praha (September 2009); Partial Reports on Extended Monitoring of Agricultural and Forest Land Around NPP Temelín for 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007 and 2008, Doc. Ing. Jan Horáček, CSc. et al, University of South Bohemia in České Budějovice; information about individual plots was searched for in the Cadastre of the Czech Office for Surveying, Mapping and Cadastre (COSMC), www.cuzk.cz. Other sources were the Public Administration Portal of the Czech Republic at http://geoportal.cenia.cz and the map server http://mapy.cz.

Rock environment and natural resources

Information about the rock environment and natural resources was obtained by a search of available literature, the preparation of the documentation did not involve any field work (drilling).

Fauna, flora and ecosystems

A Biological Assessment pursuant to Section 67 of Act no. 114/1992 Coll., on nature and landscape protection, as amended, was prepared for the assessment of impacts on fauna, flora and ecosystems, November 2009, author RNDr. Vlastimil Kostkan, PhD. The Biological Assessment was based on a number of field surveys carried out in 2009 (Rozínek et Francek 2009 a), b), c), using information on biota in the area provided in Bejček et al 2006 a), b), 2007 a), b), 2008 for comparison) and a report on environmental monitoring in the surroundings of NPP Temelín.

Landscape

The assessment of impacts on the landscape used a landscape character impact study assessing existing area characteristics and impacts on them resulting from the project. The assessment of impacts on the landscape includes area shading analysis.

Tangible assets and cultural heritage

The chapters on architectural, historical and archaeological heritage were based on information provided by the National Heritage Institute regional office in České Budějovice and the conservation section of the Culture, Conservation and Tourism Department of the South-Bohemian Regional Authority. Another source was archive material of AMEC s.r.o. The texts were prepared pursuant to Act no. 20/1987 Coll., as amended, on state care of historical heritage. Also used was information obtained from representatives of municipalities and personnel of the Temelín Power Plant, archive material of AMEC s.r.o., web sites and findings from our own surveys in the area.

Information and data for the settlement of requirements and comments arising from the conclusions of the ascertainment procedure was obtained from the Czech Statistical Office in České Budějovice and from qualified personnel of NPP Temelín. Important information was provided by the culture and tourism section of the Culture, Conservation and Tourism Department of the South-Bohemian Regional Authority.

Transport and other infrastructures

Information on transport and other infrastructure was obtained from available sources, the results of a traffic census performed by the Czech Road and Motorway Directorate in 2005, forecast coefficients for increase in traffic published by the same organisation and a forecast of traffic needs during project operation and construction.

Other

Other parts of documentation were based on available sources.

D.VI. DESCRIPTION OF LACK OF KNOWLEDGE AND UNCERTAINTIES THAT OCCURRED DURING DOCUMENTATION PREPARATION

Population and public health

Data and information provided in the area of impacts on the population and public health is sufficient to assess all relevant impacts.

Air and climate

Data and information available in the area of impacts on air and climate is sufficient to assess all relevant impacts.

Noise and other physical and biological characteristics

Data and information in the area of noise and other physical and biological characteristics is sufficient to assess all relevant impacts.

Surface water and groundwater

The topics of surface water and groundwater in relation to NPP Temelín have been well documented and monitored on a long-term basis since the preparation of the construction of the original 4x1000 MW project and the pre-operational and operational monitoring of NPP Temelín.

When preparing base studies for this documentation, the whole area was reviewed again and information on project inputs and outputs were evaluated as the potential maximum values. When doing so, no lack of knowledge was encountered that would prevent drawing conclusions or rule out the installation of the NNPP.

Soil

No shortcomings that would affect documentation conclusions were encountered during the preparation of this part of documentation. The precise route of the power output line to the Kočín switchyard was not known at the time of documentation preparation; therefore, the assessment used the extent of the corridor reserved for it in South Bohemia's territorial development guidelines.

Rock environment and natural resources

The existing NPP Temelín construction site, including the site for the new nuclear power plant, was studied in terms of the bedrock and geotechnical conditions by several stages of engineering-geological and hydrogeological survey in 1972-1989. The surveys clearly documented bedrock acceptability for the installation of a nuclear facility. A supplementary engineering-geological and hydrogeological survey will be performed at the site before the NNPP construction to verify the geotechnical conditions and determine the methods of foundation for individual NNPP structures. Much attention has been paid to the question of seismic danger to NPP Temelín in spite of its location in a low-seismicity area. The Hluboká fault is currently studied using new research methods (paleoseismology) and findings. The research will be finished in 2010. The results of the research, together with the results of research considered by the NNPP investor, will be used to evaluate the seismic potential of tectonic structures at the NNPP Temelín site and for the preparation of the seismic specification of the construction. The whole area and conclusions from the ongoing monitoring of groundwater were reviewed again during the preparation of base studies, not encountering any lack of knowledge that would rule out the NNPP installation (two additional generating units) at the site.

Fauna, flora and ecosystems

Data and information provided in the area of impacts on fauna, flora and ecosystems is sufficient to assess all relevant impacts.

Landscape

Data and information in the area of impacts on the landscape is sufficient to assess all relevant impacts.

Tangible assets and cultural heritage

No lack of knowledge or uncertainties that would prevent drawing conclusions or significantly affect assessment results were encountered during the preparation of the documentation. Base information was obtained from the studies and data of qualified expert institutions.

Since the area was already surveyed and subsequently modified during the construction of the existing power plant, there are no uncertainties due to possible insufficient research in the area.

Transport and other infrastructures

Data and information in the area of impacts on transport and other infrastructures is sufficient to assess all relevant impacts.

Other

Data and information is sufficient to assess all relevant impacts.

PART E
COMPARISON OF PROJECT VARIANTS

The proposed project has a single implementation variant, consisting in the construction of a new nuclear power plant at the Temelín site including power output to the Kočín switchyard. Other project variants are not discussed in the documentation.

The project is located at the Temelín site, which has the space and infrastructures required for the installation of a new nuclear power plant. The two new units practically fulfil the original concept of building a nuclear power plant at Temelín with four units. No other site that would meet these requirements is available for the project; therefore, no variants are proposed for project location. The same applies to the other project parts, i.e. power output to the Kočín switchyard and a raw water supply line from the Hněvkovice pumping station.

In terms of technical design, generating units with contemporary pressurised water reactors (PWR) are chosen for the project. Other reactors are not considered and are therefore not included in any project variants. Power plants with PWR reactors are delivered by several manufacturers; the following alternatives are used for reference in the documentation:

- power plant with EPR generating units,
- power plant with AP1000 generating units,
- power plant with AES-2006 generating units (trade name MIR-1200),
- power plant with EU-APWR generating units,

however, power plants with PWR reactors from other manufacturers are not ruled out if they meet licensing procedure requirements.

Safety standards are identical for all alternatives; requirements for their environmental parameters are also identical. Their impacts on all constituents of the environment are comparable and acceptable; any listed differences in environmental effects between the individual alternatives are insignificant.

The above implies that all the alternatives are identical in terms of environmental protection.

PART F
CONCLUSION

The subject matter of the performed documentation on the environmental impacts of the project

NEW NUCLEAR POWER PLANT IN TEMELÍN,
INCLUDING POWER OUTPUT TO KOČÍN SWITCHYARD

is the identification, description, evaluation and assessment of the assumed direct and indirect impacts of implementing and not implementing the project on the environment. The impacts are assessed for the project operation period as well as for its preparation and implementation period and its shutdown period. Both normal operation and the possibility of an accident are assessed. The documentation includes proposed measures to prevent adverse environmental impacts due to project execution, to eliminate, reduce, mitigate or minimise such impacts.

The documentation assesses impacts on all constituents of the environment, i.e. the population and public health, air and climate, noise and other physical and biological characteristics, surface and ground water, soil, rock environment and natural resources, fauna, flora and ecosystems, landscape, tangible assets and cultural heritage, transport and other infrastructure, and other.

During the preparation of the documentation, no facts were identified that would preclude the preparation, execution, operation and shutdown of the assessed project from an environmental point of view. Potential impacts on public health and the environment (in all of its constituents) do not exceed applicable legal limits or (if no limits are set down) an acceptable level, even if the contributory effect of the operation of the existing power plant and the existing background is taken into account. Therefore, the project will not result in any damage to the environment and public health.

Since project impacts do not manifest themselves in a significant manner in the affected area, impacts reaching over the national border are excluded.

The documentation also deals with questions of nuclear safety, radiation protection, physical protection and emergency preparedness. These issues are dealt with at the environmental level (i.e. in terms of environmental impacts), but not at the technical or organisational level (i.e. from a design, engineering or operational point of view). The above-stated conclusion is therefore valid on condition that project preparation, execution, operation and shutdown meet all requirements defined by applicable law and the requirements of applicable industry regulations and conventions within the remit of competent bodies.

PART G
GENERALLY UNDERSTANDABLE NON-TECHNICAL SUMMARY

The non-technical summary contains information about the project and conclusions from the individual subareas of the assessment of the project's possible environmental impacts in a brief and understandable form. If you are interested in more detailed information, we recommend reading the pertinent chapters of the documentation.

G.1. Basic information

ČEZ, a.s., is preparing the construction of a new nuclear power plant (NNPP) at the site of the Temelín Nuclear Power Plant (NPP Temelín). This project involves the construction of two new nuclear power units including power output to a switchyard in Kočín.

Project preparation includes environmental impact assessment pursuant to Act no. 100/2001 Coll., on environmental impact assessment, as amended. The presented documentation of project environmental impacts is a sub-step of the assessment.

The environmental impact assessment process is:

- project notification (submitted to the competent authority on 11 August 2008),
- ascertainment procedure (ascertainment procedure conclusions were published on 5 February 2009),
- environmental impact documentation (this documentation),
- environmental impact report,
- public hearing,
- opinion of the competent authority.

The competent authority is the Ministry of the Environment of the Czech Republic. The environmental impact assessment is carried out in a cross-border (international) regime; Austria and Germany joined the process.

The progress of the environmental impact assessment process can be followed on the internet in the EIA information system (http://tomcat.cenia.cz/eia/detail.jsp?view=eia_cr&id=MZP230), from where it is also possible to download related documents.

G.2. Project information

G.2.1. Subject matter of the project

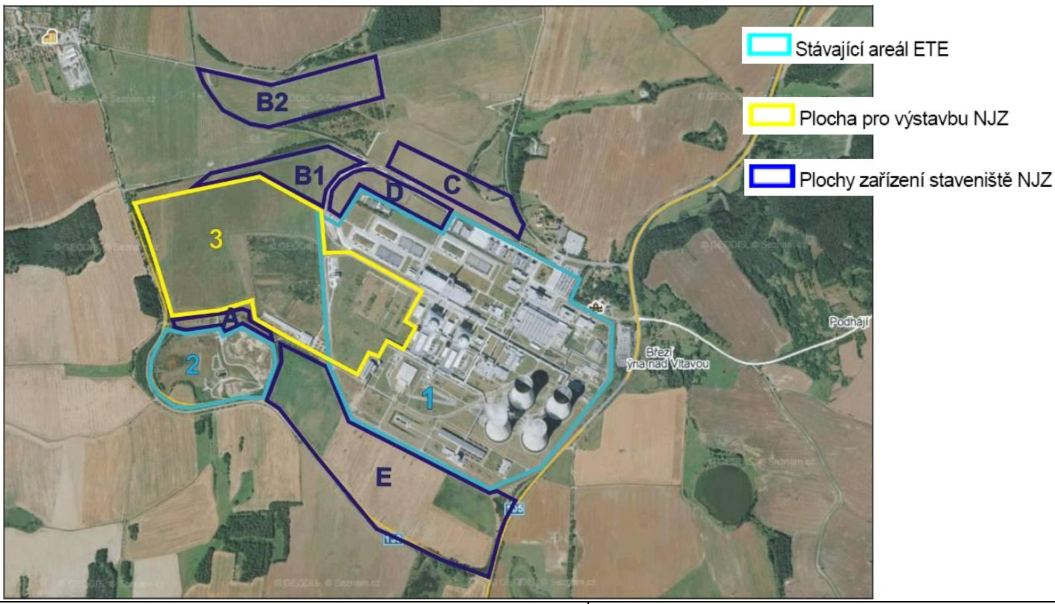
The subject matter of the project is the construction of a new nuclear power plant at the site of the Temelín Power Plant, with a total net electric power output up to 3400 MW_e (two generating units with a net power output of up to 1700 MW_e), and electric power output from the plant to a switchyard in Kočín.

G.2.2. Project location

The project is located at a site adjacent to the existing Temelín Nuclear Power Plant in operation.

The location of the project is shown in the following figure.

Figure G.1: Project location

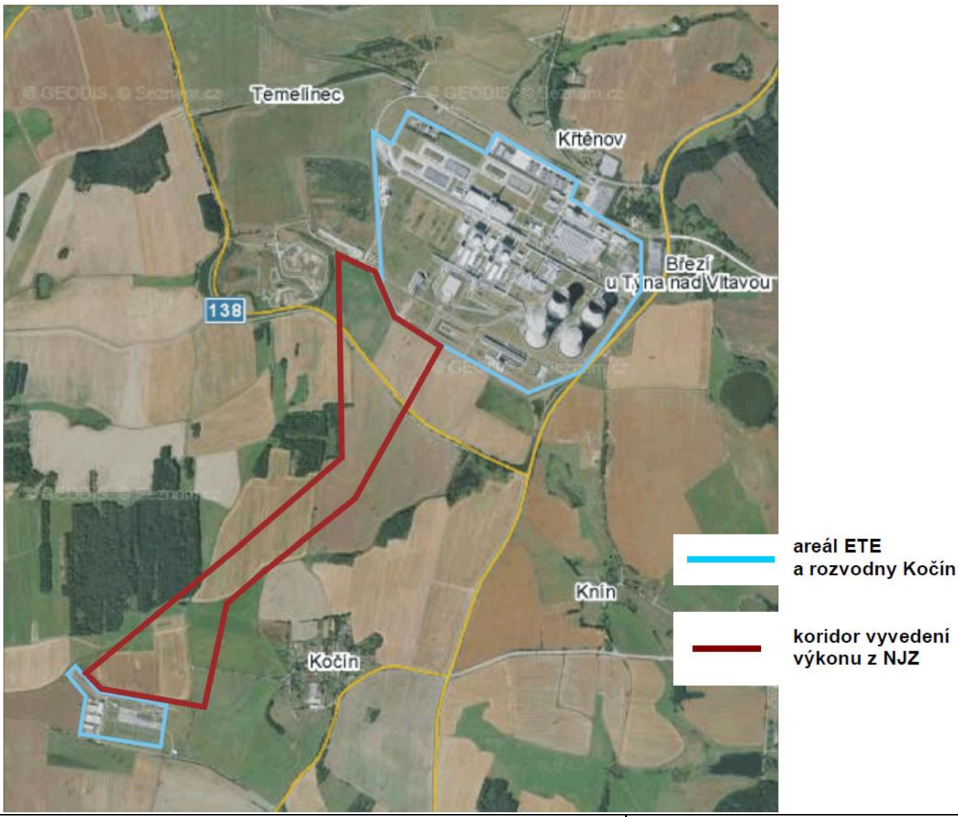


Stávající areál ETE	Existing NPP complex
Plocha pro výstavbu NJZ	Land for NNPP construction
Plocha zařízení staveniště NJZ	Land for NNPP site facilities

Area 1 indicates the existing nuclear power plant (NPP) site, area 2 indicates the area intended for waste management (inactive waste dumping ground in Temelínec) and area 3 indicates the site intended for the construction of the new nuclear power plant (NNPP). Areas A to E are intended for temporary construction site facilities.

Power lines for power output to the Kočín switchyard and spare power supply from the Kočín switchyard will be located along the existing lines between the power plant and the switchyard; similarly, possible extension of the water withdrawal pipeline from the Hněvkovice pumping station will be built along the existing pipeline.

Figure G.2: Position of corridor for power output to Kočín switchyard



Areál ETE a rozvodny Kočín	TPP and Kočín switchyard complex

G.2.3. Project justification

G.2.3.1. Justification of project purpose and necessity

The project necessity is derived from the necessity of securing electricity generation in the Czech Republic.

Electricity is essentially a decentralised source of energy. It is environmentally friendly at the point of end consumption such as in households (its use generates no pollutants) and its uses are versatile (it can be transformed into other forms of energy). The functioning of all spheres of the economy and living conditions of the population depend on the availability of electricity. Any potential deficiencies or failures in electricity supplies affect the entire society; the public interest in reliable electricity supplies is universally recognised.

However, electricity is not a primary source of energy. It has to be generated and transported to the point of end consumption.

The electricity consumption in the Czech Republic at the present (2009 data) is approximately 69 TWh a year. In spite of the current drop in consumption due to the recession, the consumption is predicted to grow to approximately 80 to 96 TWh a year by 2030, while energy intensity will decrease and savings will be made on the consumption side.

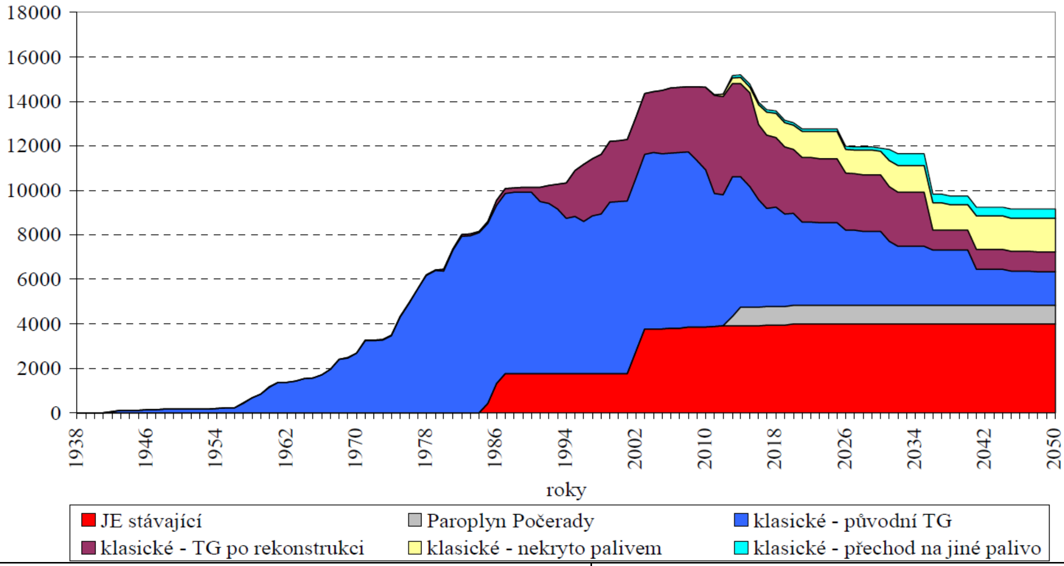
The primary energy sources of the Czech Republic are limited. The chief difficulty in the near future (after 2015 to 2030) will be to substitute for a considerable decrease in domestic coal production. Along with the renewal of the capacity of power plants near the end of their useful life, this substitution has to make use of the available energy mix, which will cover the energy demand on the consumption side (having subtracted the savings). In this context, the project is a quantitatively significant, qualitatively more than reliable, environment-friendly method of electricity production that is sustainable in the long term.

The potential of the other sources (including renewable) does not cover the requirements on reliably securing the energy needs of the Czech Republic, albeit their role in the energy mix is equally non-substitutable.

Importing energy is not an alternative for covering the energy needs of the Czech Republic. The situation in neighbouring countries concerning available primary sources is comparable to that of the Czech Republic, meaning no substantial import capacities can be expected in the future.

The following figure shows the development of the capacity of electricity sources in the Czech Republic, depending on the end of life of coal-fired plants.

Figure G.3: Installed capacity of turbine generators in the Czech Republic [MW_e], excluding the NNPP



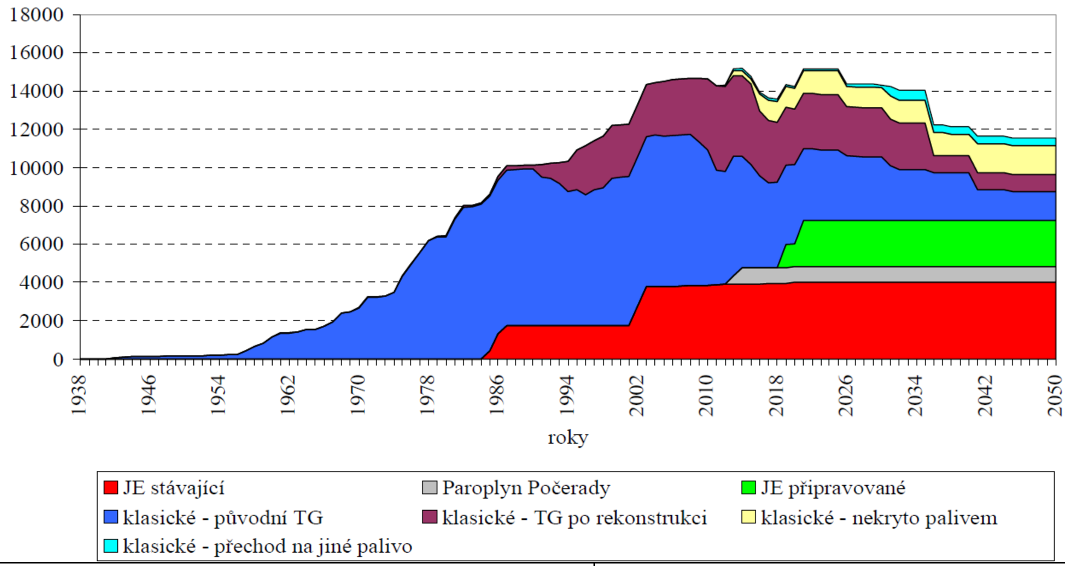
roky	Year
JE stávající	Existing NPP
Klasické – TG po rekonstrukci	Classical - TG after reconstruction
Paroplyn Počerady	Počerady steam-and-gas
Klasické – nekryto palivem	Classical - not covered by fuel
Klasické – původní TG	Classical - original TG
Klasické – přechod na jiné palivo	Classical - switch to other fuel

Although the decreasing trend in the installed capacity of coal power plants opens room for installation of new steam-gas sources (the first in Počerady Power Plant) and a massive advancement of renewable sources of energy, starting at the present, neither direction can cover the huge dropouts of steam (coal) unit capacity.

The useful life of the coal-fired units is primarily shortened by insufficient availability of domestic coal. Without the completion of a new nuclear power plant in Temelín, a huge slump would occur in the installed capacities within the electricity system, posing a threat to safe and reliable electricity supplies in the Czech Republic.

The following figure shows the same development, but including the new nuclear power plant in Temelín.

Figure G.4: Installed capacity of turbine generators in the Czech Republic [MW_e], including the new nuclear power plant in Temelín



roky	year
JE stávající	Existing NPP
Klasické – TG po rekonstrukci	Classical - TG after reconstruction
Paroplyn Počerady	Počerady steam-and-gas
Klasické – nekryto palivem	Classical - not covered by fuel
Klasické – původní TG	Classical - original TG
Klasické – přechod na jiné palivo	Classical - switch to other fuel
JE připravované	Planned NPP

Even in this case, there is a clear deficit in the installed capacity, which will have to be handled by other tools (savings, new sources including renewables, and imports if necessary), each of which has certain limitations.

G.2.3.2. Economic, social and political context of project justification

The project is in compliance with the Territorial Development Policy of the Czech Republic (TDP) passed by Government Resolution no. 929/2009 of 20 July 2009.

The project is in compliance with the National Energy Policy of the Czech Republic (NEP) passed by Government Resolution no 211/2004 of 10 March 2004. Moreover, the project satisfies the conclusions of the Independent Expert Committee for Assessment of the Czech Republic's Energy Needs in the Long Term (IEC, also referred to as the "Pačes' committee"), established on the basis of Government Resolution no. 77/2007 of 24 January 2007, which is the basis for the update of the National Energy Policy.

In all the above documents, the project is one of the assumed alternatives of electricity generation and an important part of the energy mix together with savings.

G.2.4. Project variants

G.2.4.1. Project location variants

The project is located on a site immediately adjacent to the existing Temelín Power Plant in operation.

The Temelín site was originally prepared for the installation of four nuclear power generating units, each with an electric power output of about 1000 MW_e. However, only two generating units were finished and put into operation in 2001 and 2002. The project thus respects the original plan for four power plant units, while allowing utilisation of a higher power output of available generating units. The Temelín site is appropriate in terms of both requirements on location of a nuclear energy facility and availability of necessary space, process connections and connection to the grid.

The Temelín site therefore has the space and infrastructures required for the location of the new nuclear power plant, which is the chief reason for locating the project there. The two new units practically fulfil the original concept of building a nuclear power plant at Temelín with four units. In this respect, the project location makes an effective use of available resources. No other site that would meet these requirements is available for the project.

G.2.4.2. Project technical design variants

The proposed project has a single variant, consisting in the construction of a new nuclear power plant at Temelín, including power output to the Kočín switchyard. This variant can be implemented in multiple alternatives (technical solutions).

Study work preceding the environmental impact assessment included an analysis of the latest nuclear power plant units abroad that were put into operation recently or the construction and commissioning of which is scheduled for near future. These are Generation III/III+ power plant units. This new generation makes use of operating experience with current nuclear power plants (over 5,000 reactor-years in operation) and enhances the verified design elements with additional technological improvements. Compared to Generation I and II units, the modern technologies also make it possible to simplify the units considerably. In summary, Generation III/III+ reactors feature improved safety and reliability, will have a longer useful life, better utilisation of nuclear fuel, and improved economic efficiency of operation.

Units with “pressurised water reactors” (PWR) will be used for the project, while none of the available types of pressurised water reactors complying with all terms specified by the decisions of regulatory authorities is excluded. Some of the following alternatives are assumed as reference:

- European pressurised reactor EPR,
- pressurised water reactor AP1000, developed by Westinghouse,
- pressurised water reactors derived from the well-tested Russian AES-2006 design (trade name MIR-1200),
- pressurised water reactor EU-APWR, developed by Mitsubishi.

These various technical designs do not represent project variants among which a choice should be made within an environmental impact assessment. The environmental, as well as safety requirements for all the reactor types are identical and the impacts are considered in their potential maximum, including all reactor types that can be considered for the NNPP.

G.2.5. Technical project design

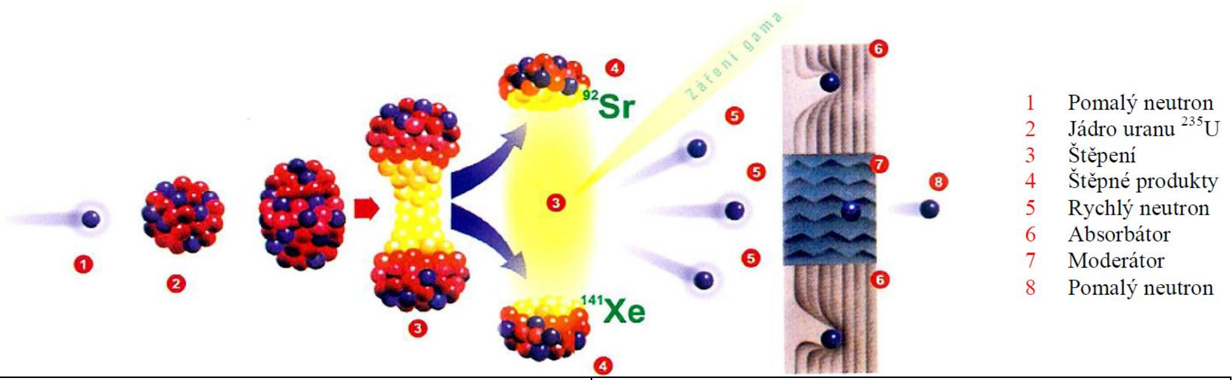
G.2.5.1. Basic specifications

The principle of electricity generation in a nuclear power plant agrees with the principle of any other thermal power plant. With some simplification, it can be described by the following chain:

- primary source of energy - fuel (coal, oil, gas, nuclear fuel, geothermal energy, etc.),
- use of fuel for generating thermal energy (coal boiler, burners, nuclear reactor, etc.),
- use of thermal energy for generating steam (boiler, steam generator),
- use of steam for generating kinetic energy (turbine),
- use of kinetic energy for generating electricity (turbo generator).

The primary element of a nuclear power plant is a nuclear reactor, in which a nuclear reaction takes place generating heat. Nuclear reactors operated at present exclusively employ nuclear fission reaction (the employment of the fusion reaction is being researched). The heat generated is then used to generate steam. The following figure shows the principle of the nuclear fission reaction.

Figure G.5: Schematic diagram of the fission reaction



Pomalý neutron	Slow neutron
Jádro uranu 235U	235U uranium nucleus
Štěpení	Fission
Štěpné produkty	Fission products
Rychlý neutron	Fast neutron
Absorbátor	Absorber
Moderátor	Moderator
Pomalý neutron	Slow neutron

The principle of the reaction consists in splitting an atomic nucleus (typically uranium ^{235}U) with a decelerated (slow) neutron. This forces the nucleus to fall into two fragments and release part of the bond energy (exploited later on as heat) and additional neutrons. Those are capable of splitting other nuclei in turn, hence the name “chain reaction”. In energy application, the chain reaction is controlled so that only one of the neutrons produced at a time provokes another fission reaction; the other neutrons are intercepted. In this case, the chain reaction continues; it neither grows larger nor diminishes. This condition is the normal operation of a nuclear reactor at a constant capacity.

The substance used in the fission is called the *(nuclear) fuel*; the substance that slows down the neutrons is the *moderator*; the substance that intercepts the neutrons is the *absorber*; and the heat-carrying medium that takes heat out of the reactor is the *coolant*.

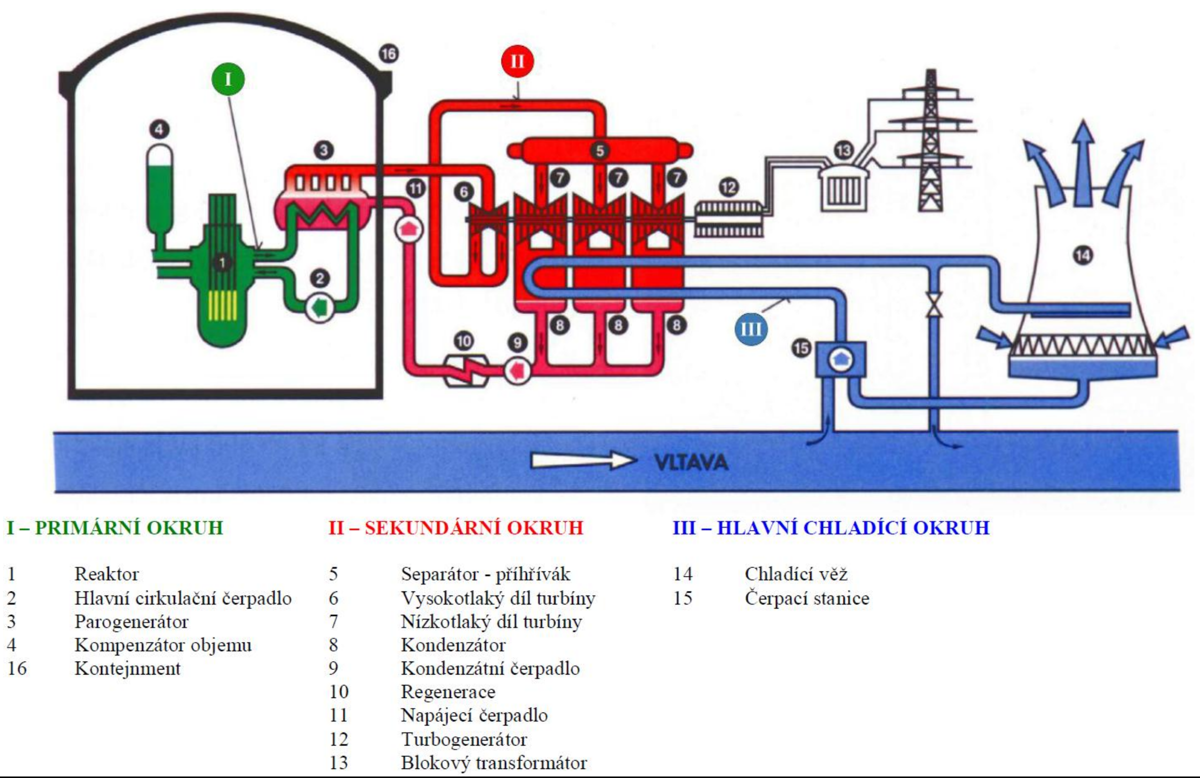
The reactor in the project is a PWR (Pressurised Water Reactor). This is a pressurised water reactor that uses uranium as the nuclear fuel (its concentration of the isotope ^{235}U has been artificially increased to no more than 5% of ^{235}U) in the form of tablets of uranium dioxide (UO_2) arranged in fuel rods. Both the moderator and coolant in this type of reactor is demineralised water (with additions of boracic acid and pH-adjusting substances), which is maintained under pressure, meaning it does not transform into steam and remains in the liquid state even at temperatures above 300°C. Fuel is replaced approximately once in 1 to 2 years while the reactor is shut down. PWR is currently the most widespread type of reactor worldwide, primarily for its safety resulting from its design.

The coolant (demineralised water) passes through the reactor, where it is heated, then enters the steam generator, where it delivers part of its thermal energy, then returns to the reactor. This circuit is called the *primary circuit*. The heat delivered by the primary circuit to the steam generator, generates steam. The steam under pressure enters the turbine, which it forces to rotate, then after it has spent its energy and condensed back into water, it is pumped back into the steam generator. This circuit is called the *secondary circuit*. The aftercooling and condensation of secondary circuit water makes use of the main *cooling circuit*, which passes through cooling towers and is replenished with treated raw water from a suitable source (the Vltava River for Temelín Power Plant). The rotary motion of the turbine is employed for actuating the electricity generator, which generates electricity, which is then evacuated into the power network.

The primary circuit devices are enclosed in a *protective envelope (containment)*, the purpose of which is both to prevent the release of radioactive substances into the environment (should the primary circuit be breached) and to protect the primary circuit devices from a potential external danger (such as a falling airplane).

The layout of a power plant with a PWR reactor is obvious from the following figure.

Figure G.6: Schematic of a power plant with a PWR unit



I – PRIMÁRNÍ OKRUH		I - PRIMARY CIRCUIT	
1	Reaktor	1	Reactor
2	Hlavní cirkulační čerpadlo	2	Reactor circulation pump
3	Parogenerátor	3	Steam generator
4	Kompenzátor objemu	6	Pressuriser
16	Kontejnment	16	Containment
II – SEKUNDÁRNÍ OKRUH		II - SECONDARY CIRCUIT	
5	Separátor – přihřívák	5	Separator – heat exchanger
6	Vysokotlaký díl turbíny	6	Turbine high pressure section
7	Nízkotlaký díl turbíny	7	Turbine low pressure section
8	Kondenzátor	8	Condenser
9	Kondenzátní čerpadlo	9	Condensate pump
10	Regenerace	10	Regeneration
11	Napájecí čerpadlo	11	Feed pump
12	Turbogenerátor	12	Turbo-generator
13	Blokový transformátor	13	Block transformer
III – HLAVNÍ CHLADÍCÍ OKRUH		III - MAIN COOLING CIRCUIT	
14	Chladící věž	14	Cooling tower
15	Čerpací stanice	15	Pumping station

The following picture shows what the Temelín Power Plant could look like when the new nuclear power plant is completed.

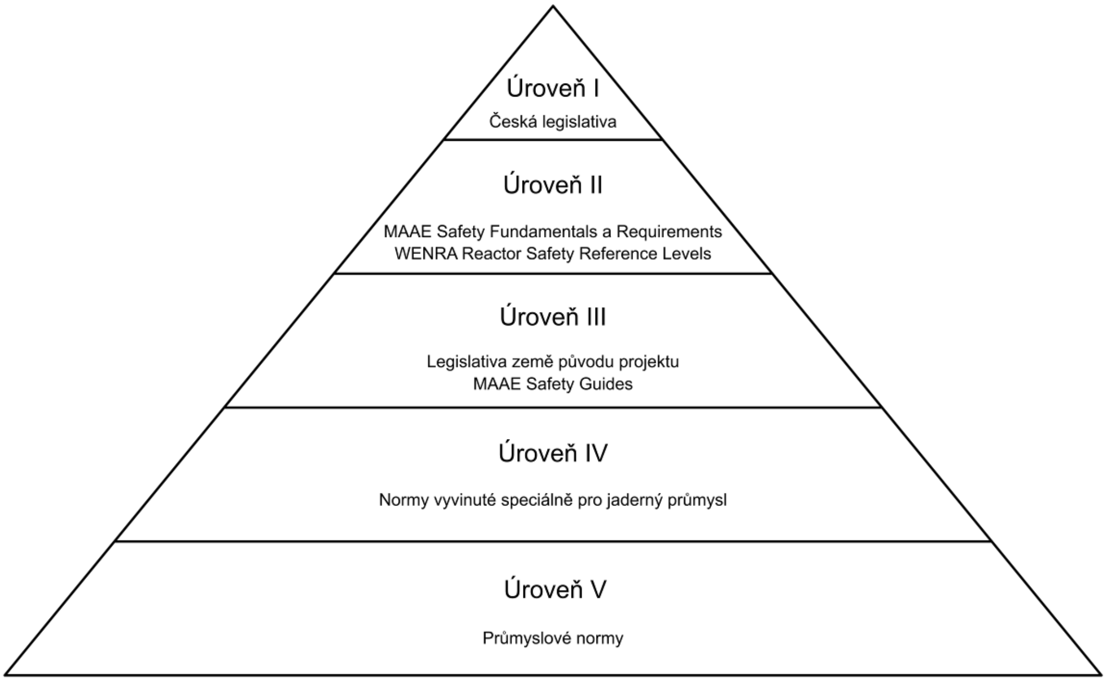
Figure G.7: Visualisation of the possible appearance of the Temelín Power Plant with the new nuclear power plant

The existing four cooling towers are in the background, with two existing generating units in front of them, two generating units of the new nuclear power plant in front of those and cooling towers for the new nuclear power plant (either four or two cooling towers in total) on the right in the front. Even though the picture is only schematic, it is obvious that the plan for a new power plant is in line with the original plan for four nuclear power generating units on the Temelín site.

G.2.5.2. Information on nuclear safety

The design, erection (construction), operation and subsequent decommissioning of the power plant will follow applicable regulations and standards, both national (which are at the top level) and international. The hierarchy of regulations and standards is shown in the following figure.

Figure G.8: Hierarchy of regulations and standards



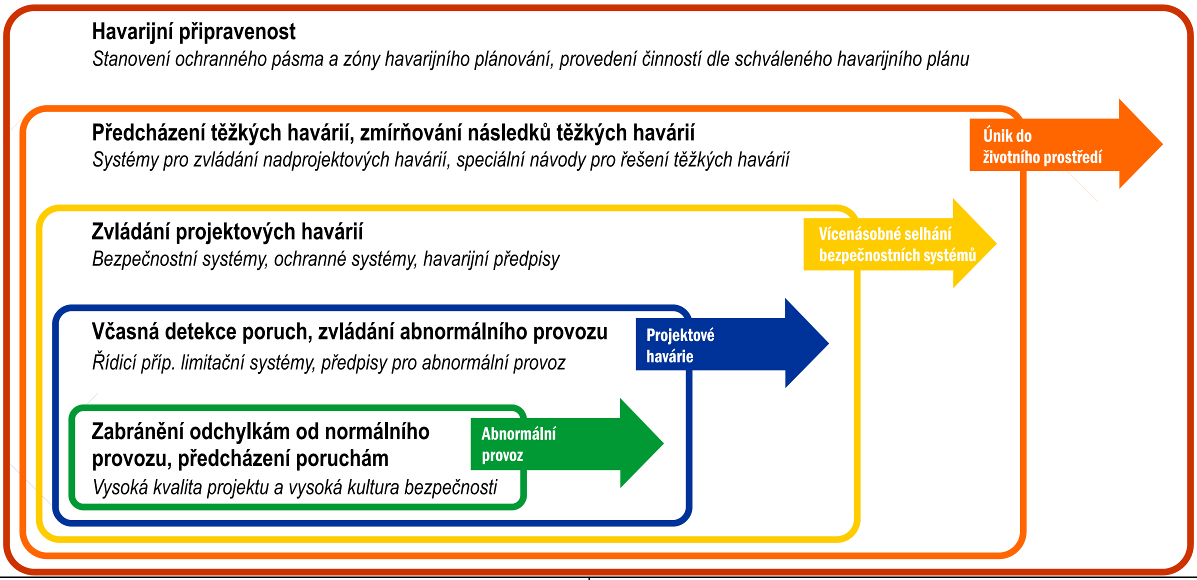
Úroveň I	Level I
Česká legislativa	Czech legislation
Úroveň II	Level II
MAAE Safety Fundamentals and Requirements	IAEA Safety Fundamentals and Requirements
WENRA Reactor Safety Reference Level	WENRA Reactor Safety Reference Level
Úroveň III	Level III
Legislativa země původy projektu	Nuclear Safety Regulation used during licensing process of the Reference Plant and Standard Design
MAAE Safety Guides	IAEA Safety Guides
Úroveň IV	Level IV
Normy vyvinuté speciálně pro jadrný průmysl	Nuclear oriented codes and standards
Úroveň V	Level V
Průmyslové normy	Conventional Codes and Standards

As results from the information provided, the nuclear plant is/will be constructed in compliance with all applicable requirements resulting from valid regulations and standards. The project will make as much use as possible of designs sufficiently verified in previous projects. The functionality and reliability of new designs will be demonstrably documented.

The project will assure achieving the fundamental safety objective, which is to protect the population and the environment against the undesirable effects of ionising radiation associated with plant operation. In addition, necessary measures will be taken to prevent and cope with emergency conditions resulting from either internal failures or external influences in accordance with the principles of defence in depth. All legal exposure limits will be complied with, respecting the basic radiation protection principle of using optimisation procedures to keep exposure as low as reasonably achievable, economic and social factors being taken into account (the ALARA principle).

In compliance with safety requirements, the power plant design will apply the defence in depth principle, which is based on using multiple physical barriers to prevent the leak of radioactive substances and ensuring integrity of these barriers with a system of complementary technical and organisational measures. Both the measures and the physical barriers are arranged in a way that if a lower-level measure or barrier fails, a higher-level measure and barrier is applied in the next step. The application of the defence in depth principle ensures that even with multiple equipment or operator failures at multiple levels of protection, the population and the environment will not be endangered.

Figure G.9: Schematic diagram of the principle of protection in depth



Havarijní připravenost	Emergency preparedness

Stanovení ochranného pásma a zóny havarijního plánování, provedení činnosti dle plánovaního havarijního plánu	Defining protection zone and emergency planning zone, taking actions according to approved emergency plan
Předcházení těžkých havarií, zmírňování následků těžkých havárií	Preventing heavy accidents, alleviating consequences of heavy accidents
Systémy pro zvládání nadprojektových havárií, speciální návody pro řešení těžkých havárií	Systems for coping with beyond design basic accidents, special guidelines for dealing with heavy accidents
Zvládání projektových havárií	Coping with design basic accidents
Bezpečnostní systémy, ochranní systémy, harijní předpisy	Safety systems, protective systems, emergency regulations
Včasná detekce poruch, zvládání abnormálního provozu	Early fault detection, coping with abnormal operation
Řídící příp. limitační systémy, předpisy pro abnormální provoz	Control or limitation systems, abnormal operation regulations
Zabránění odchylkám of normálního provozu, předcházení poruchám	Avoiding deviations from normal operation, fault prevention
Vysoká kvalita projektu a vysoká kultura bezpečnosti	High project quality and high safety culture
Únik do životního prostředí	Escape into environment
Vícenásobné selhání bezpečnostního systému	Multiple safety system failure
Projektové havárie	Design basic accidents
Abnormální provoz	Abnormal operation

The physical barriers against leaks of radioactive substances are the nuclear fuel material and the hermetic coat of the fuel cells, the pressure boundary of the primary circuit and the protective envelope system (containment). These barriers will be designed so that the integrity of all the barriers during operating states is preserved. During emergencies, the integrity of the barriers will be preserved insofar as they can perform safety functions. During a serious accident, the integrity of at least one barrier, i.e. the containment, will be preserved.

Figure G.10: Physical barriers to leakage of radioactive substances

Materiál jaderného paliva	Nuclear fuel material
Hermetický povlak palivových článků	Hermetic fuel cell sheath
Tlaková hranice primárního okruhu	Primary circuit pressure boundary
Vnitřní hermetická obálka	Internal hermetic envelope
Vnější ochranná obálka	Containment

G.3. Information on environmental impacts

G.3.1. State of the environment

The affected area (the surroundings of the Temelín Nuclear Power Plant) is of favourable environmental quality, complying with regulatory requirements and comparable to similar areas within the Czech Republic.

The operation of the Temelín Nuclear Power Plant itself is monitored and evaluated from both the radiological and non-radiological aspects. The results of the monitoring give evidence that the impacts of the plant operation on ambient environment are acceptable and comply with legislative requirements and regulatory limits and licensing conditions for operation.

The health of the population in the neighbourhood of the Temelín Nuclear Power Plant is continuously assessed based on available data, with focus on potential impacts of the power plant construction and operation, in studies performed by the Department of Preventive Medicine of the Faculty of Medicine of Masaryk University in Brno. Both the pre-operational period (from the early 1990s to 2001) and the operational period (from 2001 onwards) are evaluated as a whole. No proof of potential negative health impacts from NPP Temelín on the population in the neighbourhood was established in any of the two compared periods and in any health indicator. Identified changes and variations in health parameters, both favourable and unfavourable, exist randomly in the evaluated areas, without any relation to NPP Temelín. Evaluations of mental stability, life satisfaction level and occurrence of fears and anxieties in the population indicate a statistically significantly lower level of neuroticism, a lower level of depressive states and a higher level of satisfaction with one's own life and the level of its enjoyment.

No significant problems were identified in the other constituents of the environment. The radiation situation corresponds to the natural background; the existing plant's operation contributes to the radiation burden in the area insignificantly.

G.3.2. Environmental impacts of the project

The project's expected impacts on public health and all constituents of the environment are very low and acceptable.

An analysis of health risks indicates that the radiological consequences of the operation of the new nuclear power plant will not pose a threat to the health of the population in the closes contact with the power plant or in more distant areas. The possible health risk, assessed in compliance with the strictest international requirements, is virtually zero. Adding radiation doses from current plant operation to any variant of the new nuclear power plant will not increase the order of magnitude of total radiation doses and the health risks resulting from them; their numeric values will change only slightly. This makes the total impact of the new power plant and the two existing power plant units well acceptable, too. This conclusion can also be applied to areas on the Czech Republic's borders with all neighbouring countries.

Noise issues can be handled within applicable limits. The power plant is located at a great distance from a protected area; measures to protect such areas from noise are manageable.

Potential impacts on the climate and weather, resulting mainly from the operation of cooling towers, which release waste heat from the plant into the air, are so insignificant that they virtually preserve the existing situation / its natural fluctuation in the area. The discharge of warmed wastewater into the Vltava will not cause such changes in its temperature that would be outside the natural conditions and their year-to-year changes.

The project is not a significant source of air pollution.

Impacts on area drainage are insignificant. The withdrawal of process water by the Temelín Power Plant will have an impact of little significance on the Vltava; in low-water periods, flow rates in the Vltava can be improved by reservoirs upstream of the Hněvkovice reservoir in accordance with their operation rules to maintain the minimum required flow rate. The yields and quality of ground water sources will not be affected. The quality of surface water will be affected by plant operation in relatively little significance in most indicators and will comply with applicable law.

The project will be located on land originally intended for the construction of plant units 3 and 4 (which has already been unregistered as an agricultural land resource) and on adjacent land that is partially included in agricultural land resources. This land was previously used for construction site facilities during the building of plant units 1 and 2.

The integrity and quality of the rock environment will not be disturbed; mineral resources will not be affected. The Temelín Power Plant has a system of management of all generated waste, which will also be suitable for the new power plant. There are therefore no additional demands for waste management systems, which could cause additional negative impacts on soil, area or geological conditions as a result of waste deposition.

No rare or irreplaceable natural phenomenon will be lost or damaged due to plant operation. An area that has become the habitat of protected amphibian species is located at the site intended for the construction of the new power plant, namely at the repository of earth from the construction of units 1 and 2. Before construction, the species will be translocated to suitable substitute habitats, built in advance. The forecast of the development of the environment in the area does not indicate any changes that might harm plant and animal communities. There are no impacts on specially protected natural elements.

Plant operation does not result in any negative impacts on buildings, architectural or historical heritage. Impacts on traffic are low.

The power plant negatively impacts the aesthetics of the wide surroundings; this situation will be virtually preserved after project implementation, the extent of visually affected and shaded area will change to a small extent. There is no impact on the recreational use of the area.

Impacts in the construction period, consisting mainly in noise impacts (construction work and construction traffic) and in impacts on air (dust formation at the site, operation of machinery and construction traffic), can be expected to be more significant than impacts in the operation period. However, the impacts will be acceptable overall and will be restricted to the period in which work will be carried out. Measures will be taken to minimise/compensate the adverse impacts.

In addition, impacts in the shutdown period (after the project's service life expires, i.e. after several tens of years) can be expected to be acceptable.

Risks associated with project operation will not exceed risks from the operation of the existing plant and will be much lower. The radiological consequences of analysed accident conditions evidence the acceptability of environmental risks.

The results of design basis accident assessment show that with the hypothetical accident chosen, the exposure of humans does not necessitate taking any urgent protective measures in the nearest residential area. In addition, it is highly unlikely that it should be necessary to take subsequent protective measures (food chain control) across the borders with neighbouring states. When the radiological impacts of a severe accident are modelled, guidance values for the introduction of urgent protective measures beyond the existing NPP Temelín emergency planning zones are not exceeded. The current extent of the emergency planning zone (inner and outer zone) will not have to be changed due to the project.

G.3.3. Summary

The environmental impact documentation assesses impacts on all constituents of the environment, i.e. the population and public health, air and climate, noise and other physical and biological characteristics, surface and ground water, soil, rock environment and natural resources, fauna, flora and ecosystems, landscape, tangible assets and cultural heritage, transport and other infrastructure, and other.

During the preparation of the documentation, no facts were identified that would, from an environmental point of view, preclude the preparation, execution, operation and decommissioning of the assessed project of building a new nuclear power plant at the Temelín site including power output to the Kočín switchyard. Potential impacts on public health and the environment (in all of its constituents) do not exceed applicable legal limits or (if no limits are set down) an acceptable level, even if the contributory effect of the operation of the existing power plant and the existing background is taken into account. Therefore, the project will not result in any damage to the environment and public health.

PART H
ANNEXES

Annexes 1 and 2 are included after the main text of this documentation in the same volume.

Annexes 3 to 8 form separate volumes, identified as Volume 1 to Volume 3.

List of annexes:

Annexe 1 Documents

1.1 Opinion of the competent building authority on the project in terms of land use planning documentation
1.2 Opinion of the nature conservation authority on possible effect on sites of Community importance and/or bird areas
1.3 Letter of the Ministry of the Interior of the Czech Republic dated 24 September 2009
1.4 Letter of the Radioactive Waste Repository Authority dated 14 September 2009
1.5 Authorisation certificates of persons involved in the elaboration of the documentation

Annexe 2 Map and layout annexes

2.1 Layout 1:400,000
2.2 Layout overview 1:37,500
2.3 NPP Temelín orthophoto with plot of NNPP construction site, 1:7,000

2.4a NNPP Temelín model alternative AES-2006 - views
2.4b NNPP Temelín model alternative AES-2006 - 3D model
2.4c NNPP Temelín model alternative AES-2006 - sectional view of generating unit
2.4d NNPP Temelín model alternative AES-2006 - aerial view I
2.4e NNPP Temelín model alternative AES-2006 - aerial view II

2.5a NNPP Temelín model alternative AP1000 - views
2.5b NNPP Temelín model alternative AP1000 - 3D model
2.5c NNPP Temelín model alternative AP1000 - sectional view of generating unit
2.5d Temelín NNPP model alternative AP1000 - aerial view I
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2.6a NNPP Temelín model alternative EPR - views
2.6b NNPP Temelín model alternative EPR - 3D model
2.6c NNPP Temelín model alternative EPR - sectional view of generating unit
2.6d NNPP Temelín model alternative EPR - aerial view I
2.6e NNPP Temelín model alternative EPR - aerial view II

2.7a NNPP Temelín model alternative EU-APWR - views
2.7b NNPP Temelín model alternative EU-APWR - 3D model
2.7c NNPP Temelín model alternative EU-APWR - sectional view of generating unit
2.7d NNPP Temelín model alternative EU-APWR - aerial view I
2.7e NNPP Temelín model alternative EU-APWR - aerial view II

2.8a NNPP Temelín model alternative AES-2006 with one cooling tower per unit - views
2.8b NNPP Temelín model alternative AES-2006 with one cooling tower per unit - 3D model
2.8c NNPP Temelín model alternative AES-2006 with one cooling tower per unit - aerial view

2.9a NNPP Temelín model alternative AP1000 with one cooling tower per unit - views
2.9b NNPP Temelín model alternative AP1000 with one cooling tower per unit - 3D model
2.9c NNPP Temelín model alternative AP1000 with one cooling tower per unit - aerial view

Annexe 3 Population and public health

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3.2 Assessment of impacts on public health

Annexe 4 Air and climate

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4.2 Dispersion analysis of operation of construction machinery on main site and site facilities areas during NNPP construction
4.3 Dispersion analysis of dustiness due to construction works on the main site and site facilities areas
4.4 Dispersion analysis of traffic during NNPP operation
4.5 Dispersion analysis for operation of air-polluting NNPP point sources (except radioactive discharges and impact of cooling towers on microclimate)
4.6 Assessment of the impact of cooling towers on climate characteristics

Annexe 5 Surface water

5.1 Feasibility study of water withdrawal
5.2 Assessment of the impact of discharged wastewater on surface water

Annexe 6 Noise

6.1 Acoustic study - impact of the current and future operation of the plant
6.2 Acoustic study - impact of current and future traffic loads
6.3 Acoustic study - noise from construction work

Annexe 7 Flora, fauna and ecosystems

7.1 Biological assessment

Annexe 8 Landscape

8.1 Assessment of impacts on the landscape
8.2 Assessment of impacts on area shading

END OF MAIN DOCUMENTATION TEXT

The documentation elaboration date, the documentation author’s signature and a list of persons involved in the elaboration of the documentation can be found at the beginning.