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THE CZECH REPUBLIC
NATIONAL REPORT

under the Convention on Nuclear Safety

Prague 2022

THE CZECH REPUBLIC NATIONAL REPORT UNDER THE CONVENTION ON NUCLEAR SAFETY

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INTRODUCTION

This Report has been drawn up as the National Report of the Czech Republic for the purposes of a review by the parties to the Convention on Nuclear Safety. This Report has been elaborated with the objective to describe fulfilment of obligations arising from the Convention by the Czech Republic up to April 30, 2019. Based on the decision to merge the 8th and 9th Review Meetings, the 2019 Report was updated to describe the situation as of April 30, 2022. The structure of the National Report is based on recommendations published as Guidelines Regarding National Reports under the Convention on Nuclear Safety", INFCIRC/572/Rev. 6 of 19 January 2018.

By the above-mentioned date the Czech Republic had two operating nuclear installations covered by the Convention on Nuclear Safety – both operated by the ČEZ, a. s.

These include particularly:

Dukovany Nuclear Power Plant (Dukovany NPP) with four reactor units of VVER 440/213. The units were commissioned in the following years as follows (years in brackets are the dates of issue of final inspection approvals according to Building Act):

Unit 1 – 1985 (1988),

Unit 2 – 1986 (1988),

Unit 3 – 1987 (1989),

Unit 4 – 1987 (1990),

and Temelín Nuclear Power Plant (Temelín NPP) with two reactor units VVER 1000/320. Both units were put into operation in accordance with the Atomic Act in 2004.

Nevertheless, the basic philosophy and principles of nuclear safety assurance applied to these two nuclear power plants have been correspondingly applied also to the other nuclear installations in the Czech Republic– three research reactors, Interim Spent Fuel Storage Facilities in Dukovany and Temelín NPPs and Radioactive Waste Repository. The last two nuclear installations are, with regard to their nature, subject of evaluation under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Above and beyond obligations arising from the Convention on Nuclear Safety, information on research nuclear reactors is included in the Annex 8.

LIST OF ABBREVIATIONS

AMP	Ageing Management Program
AOP	Abnormal Operating Procedures
AOT	Allowed Outage Time
AQG	Atomic Question Group
ASSET	Assessment of Safety Significant Events Team
Atomic Act	Act No. 263/2016 Coll., Atomic Act
CDF	Core Damage Frequency
ČEZ, a. s.	Business name of the Czech utility – joint stock company, operator of the Dukovany and Temelín Nuclear Power Plants
ČR	Czech Republic
DAM	Diverse and Mobile
DG	Diesel Generator
Dukovany NPP	Dukovany Nuclear Power Plant
ECC	Emergency Command Centre
ECURIE	European Community Urgent Radiological Information Exchange
EDMG	Extensive Damage Mitigation Guideline
EIA	Environmental Impact Assessment
EMS	Environmental Management System
ENSREG	The European Nuclear Safety Regulators Group
EOPs	Emergency Operation Procedures
EPRI	Electric Power Research Institute
EPS	electronic fire alarm system
ERO	Emergency response organisations
ESFAS	Engineered Safety Features Actuation System
EU	European Union
FDF	Fuel Damage Frequency
HPES	Human Performance Evaluation System
HVB	Main production unit
HZS	Fire Rescue Service
I&C	Instrumentation and Control System
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiation Protection
IERO	internal emergency response organisation
INES	International Nuclear Event Scale
INPO	Institute of Nuclear Power Operators
INSAG	International Nuclear Safety Advisory Group
IPERS	International Peer Review Service

IPPAS	International Physical Protection Advisory Service
IPSART	International Probabilistic Safety Assessment Review Team
IRRS	International Regulatory Review Service
IRRT	International Regulatory Review Team
IRS	Incident Reporting System
ISO	International Standard Organization
I.O.	Primary circuit
II.O.	Secondary circuit
JRC	Joint Research Centre
LERF	Large Early Release Frequency
LTO	Long Term Operation
MCR	main control room
MCP	Main Circulation Pumps
MonRaS	Database of the results of radiation situation monitoring operated by the SÚJB
NATO	North Atlantic Treaty Organization
NJZ	New nuclear facility
NPP	Nuclear Power Plant
NUREG	Nuclear Regulation
NRHP	National Radiation Emergency Plan
NS-G	Safety Guide (IAEA)
OBK	Civil Safety Commission
OECD-NEA	Organisation for Economic Co-operation and Development – Nuclear Energy Agency
OHS	Occupational Health and Safety
OSART	Operational Safety Review Team
PHARE	Technical Assistance Program organized by the European Commission
PSA	Probabilistic Safety Assessment
PSHA	Probabilistic Seismic Hazard Assessment
PSR	Periodic Safety Review
RCLS	Reactor Control and Limitation System
SALTO	Safe Long Term Operation
SAMGs	Severe Accident Management Guidelines
SDR	Special Drawing Rights
SSC	Systems, structures and components
Temelín NPP	Temelín Nuclear Power Plant
TSO	Technical Support Organisation
TSR	Technical Safety Review
SÚJB	State Office for Nuclear Safety
SÚJCHBO	National Institute for Nuclear, Chemical and Biological Protection

SÚRAO	Radioactive Waste Repository Authority
SÚRO	National Radiation Protection Institute
TLAA	Time Limited Ageing Analyses
TLD	Thermoluminiscent dosimeter
TPR	Topical Peer-Review
TPS	Technical Support Centre
TSR	Technical Safety Review
ÚRAO	Radioactive Waste Repository
US NRC	US Nuclear Regulatory Commission
VCNP	Civil Emergency Planning Committee
VDNS	Vienna Declaration on Nuclear Safety
VÚV TGM	T. G. Masaryk Water Research Institute
VVER (WWER)	Type identification for pressurized water reactors designed in the former Soviet Union
WANO	World Association of Nuclear Operators
WENRA	Western Nuclear Regulatory Association

SUMMARY

This Report is the National Report of the Czech Republic prepared for the purposes a review by the parties to the Convention on Nuclear Safety. This Report has been elaborated to describe the fulfilment of obligations arising from the Convention by the Czech Republic up to April 30, 2019. Based on the decision to merge the 8th and 9th Review Meetings, this Report was updated to describe the situation as of April 30, 2022. The structure of the National Report is based on recommendations published as Guidelines Regarding National Reports under the Convention on Nuclear Safety", INFCIRC/572/Rev. 6 of 19 January 2018.

Since the National Report, compiled in April 2016, the following events occurred in the Czech Republic in the areas addressed in the Convention on Nuclear Safety and the following relevant assessments were carried out:

Following the intense legislative work in previous years, the efficiency of comprehensive legislation in the field of peaceful use of nuclear energy and ionising radiation took effect on January 1, 2017. Namely, it was Act No. 263/2016 Coll., the Atomic Act (hereinafter referred to as the "Atomic Act"), and the related implementing legislation. Another follow-up step, which has been ongoing since 2017, is the complete review and revision of all existing safety guides of the State Office for Nuclear Safety (SÚJB).

Regarding the two nuclear power installations covered by the Convention on Nuclear Safety – the Dukovany Nuclear Power Plant (EDU) and the Temelín Nuclear Power Plant (ETE):

In the case of the EDU, following the Periodic Safety Review (PSR) conducted after 30 years of operation, licences for the further operation were gradually issued between 2015 and 2017. Their issuance was always preceded by six-month administrative procedure, during which the applicant for a licence ČEZ, a. s., once again had to produce evidence of compliance with the principle of safe use of nuclear energy in terms of the requirements for nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security of a nuclear installation, following the entry into force of the Atomic Act.

In the case of the ETE, the PSR has been conducted since 2017 after 20 years of operation under the amended legislation of the Czech Republic. Results of the PSR were submitted to the SÚJB in early 2020 in connection with the planned renewal of a licence for operation in 2020. The licence for the first unit was issued by the SÚJB on September 24, 2020, based on an application by ČEZ, a. s., submitted on March 25, 2020. A similar procedure is currently underway for the second unit; ČEZ, a. s., applied on November 30, 2021, the administrative time limit is six months according to the Atomic Act.

Furthermore, in line with the National Action Plan for the Development of the Nuclear Energy Sector, preparations for the construction of new nuclear facilities are underway, which is discussed in detail in Chapter 17.1.5.

On March 25, 2020, the company Elektrárna Dukovany II, a. s., which is the subsidiary of the ČEZ, a. s., applied for a licence for siting two nuclear units in the Dukovany site – "New Nuclear Unit in the Dukovany Site" (NJZ EDU). The parent company ČEZ, a. s., performs the function of a controlling entity following the Act on Business Corporations. Each of the nuclear installations includes one nuclear unit with an output of up to 1,200 MWe with one heterogeneous pressurized water reactor. The area for the siting of the new units is directly connected to the area of the existing Dukovany NPP in operation, which is owned by ČEZ, a. s.

The administrative procedure thus initiated was completed on March 8, 2021, when the SÚJB issued a permit for the siting of two nuclear power units in the Dukovany site. The decision was made under the provisions of Section 9(1) a) of the Atomic Act.

Based on the request of ČEZ, a. s., of August 21, 2020, and the amended documentation for the siting of Temelín NPP Units 3 and 4, a new permit for the siting of nuclear facilities of Units 3 and 4 in the Temelín site was issued by the SÚJB on November 4, 2020 (valid for an indefinite period of time according to the Atomic Act).

The implementation of the conclusions of the International Regulatory Review Service (IRRS) mission of November 2013 was reviewed by a follow-up mission in May 2017, as described in Chapter 8. In addition, the licence holder (operator of the two nuclear power plants) ČEZ, a. s., was subjected to a several international missions, which are summarized in Chapter 6.

In line with the National Action Plan for Nuclear Safety Enhancement in Nuclear Installations, implementation of the measures arising from the stress tests continued and its revision 5 has been completed in February 2022 (see Annex 3). It includes the measures to maintain the long-term integrity of the ETE containment based on the selected severe accident management strategies. Addressing this issue has been analysed and developed on a long-term basis, but given the long-term nature of activities, fulfilment of this objective is still underway. To continuously enhance the level of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security, as provided for by the Atomic Act, ČEZ, a. s., develops and annually updates the Plans for Safety Enhancement of both nuclear power plants (see Annex 4).

In the period from 2016 to 2017, an international review (Topical Peer-Review) took place in each member state of the European Union (EU) with a nuclear energy program, including the Czech Republic, pursuant to Article 8e of Council Directive 2014/87/EURATOM of July 8, 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations in the segment of “Ageing Management” to continuously enhance nuclear safety, which included the EDU as well as the ETE. This review was specifically focused on the reactor pressure vessels, the integrity of “concealed” pipework and electrical cables (for details see Chapter 14.2).

The implementation of the new management system of the SÚJB was completed, as discussed in more detail in Chapter 8, which includes a discussion on the issue of the SÚJB staffing. Strengthening of the external support to regulatory activities of the SÚJB (Technical Support Organization – TSO) for nuclear safety continued within the National Radiation Protection Institute (SÚRO).

System changes were also made with the licence holder. ČEZ, a. s., which made the organisational changes in response to findings of 2015, when weaknesses significantly showed in the activity management system, in particular in the supervision of the quality of the activities of supply organisations. The Production Division was divided into the Nuclear Energy Division and the Conventional Energy Division. Through the creation of the Nuclear Energy Division, the ČEZ responded to the need to meet the requirements of the amended Atomic Act and implementing decrees, and to keep enhancing the level of safety of nuclear power plants. Therefore, all units engaged in the activities related to nuclear energy utilization are concentrated in a separate division. Further steps were aimed at ensuring sufficient human resources needed for the implementation and evaluation of non-destructive testing in the case of work performed by contractors to ensure human resources for inspecting the delivered performance. A new workplace was established for education, training and certification for staff involved in welding and non-destructive testing.

COVID-19

SÚJB

The course of the pandemic required the SÚJB to take several actual measures to manage it. On the other hand, it showed that legal requirements within the competence of the Office, as well as the procedural procedures regulated by legislation, are universal and applicable without exceptions even during such a demanding period of time. The pandemic situation in the Office has not led to a reduction in the level of culture or the degree of compliance with legal requirements by their addressees;

therefore it requires no direct changes in legislation. Certain new methods of work, such as inspections using audiovisual transmissions, have proved to be effective and beneficial for the performance of current agendas and lead to considerations about their potential transposition into SÚJB's internal regulations in the future.

ČEZ, a. s.

Even during the pandemic, the primary goal of the licence holder was to ensure the safe operation in normal, abnormal and accident conditions, and to implement NPP outages within the specified time limits and to the specified extent. Therefore, not only general hygiene measures were introduced in the localities (Hands – Mask – Distance, i.e. disinfection tanks were installed at workplaces, the obligation to wear respirators (at the workplace, at bus stops and in buses), measures in canteens and cafeterias (protective plexiglass, worker testing for COVID-19), but measures were also taken in the organization of activities: daily report and monitoring of the current number of workers on shift, changes in operating schedules to keep two shifts in reserve, adjustments in the organization and management of outages (protection outage centre, revision of investment and maintenance work, limited training, and psychodiagnostics). All employees who did not have to perform activities at the place of work were assigned home office; the duties of managers and employees at the home office were defined and communication technology was used to a much greater extent (Teams, Skype, etc.).

Status of "Challenges" recognized at the 7th Review Meeting and being prepared for the 8th Review Meeting.

Regarding the Challenges, as stated in the draft report of the reporter on the assessment of the Czech Republic at the 8th Review Meeting in 2020, the status of their fulfilment is as follows:

- Challenge 2020-01 (continued Challenge 2017-04) to implement the Action Plan is discussed in Annex 3.
- Challenge 2020-02 (continued Challenge 2017-02) – preparation of Safety Guides following the new legislation is described in Chapter 7.2.1.
- Challenge 2020-03 concerning the National Radiation Emergency Plan is described in Chapter 16.1.3.3.
- Challenge 2020-04 the ongoing development of the TSO (SÚRO) to ensure the support of the Nuclear Safety Section of the SÚJB is described in Chapter 8.1.11.
- Challenge 2020-05 to ensure the transfer of knowledge and experience of experts leaving the SÚJB to new colleagues is described in Chapter 8.1.5 and Chapter 8.1.6.

Regarding the Challenges from the 7th Review Meeting, as stated in the draft report of the reporter on the assessment of the Czech Republic at the 8th Review Meeting in 2020, the status of their fulfilment is as follows:

- Challenge 2017-01 concerning the case of welds as described in Chapter 6.6, Case of welds.
- Challenge 2017-02 – moved under Challenge 2020-02, see above.
- Challenge 2017-03 concerning the strategy in the field of human resources is presented in Chapters 8.1.5 and 8.1.6 for a state supervisory authority (SÚJB) and in Chapter 11.2 for an operator of a nuclear installation.
- Challenge 2017-04 – moved under Challenge 2020-01, see above.
- Challenges 2017-05 on the Management System of the SÚJB as described in Chapter 8.1.9.

6. EXISTING NUCLEAR INSTALLATIONS

Each contracting party shall take appropriate steps to ensure that the safety of nuclear installations at the time the Convention enters into force for that contracting party is reviewed as soon as possible. When necessary in respect to the Convention, the contracting party shall ensure that all reasonably practicable improvements are urgently made to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be outlined to shut down the nuclear installation as soon as practically possible. The timing of the shutdown may take into account the general situation in energy production and potential alternatives, as well as the social, environmental and economic consequences.

6.1 Nuclear installations in the Czech Republic as defined in Article 2 of the Convention

At present there are the following nuclear installations operated in the Czech Republic (as defined in Article 2 of the "Convention"):

- Dukovany NPP: four VVER 440/213 reactor units;
- Temelín NPP: two VVER 1000/320 reactor units.

The geographic locations of both the Czech nuclear power plants are shown in Fig. 6-1 and technical data of both NPPs can be found in Annex 2.

Since early 1990s, safety level has been reassessed in the form of analysis carried out by licensee or state supervision (for example, see Chapter 14), or external independent assessment within the framework of international missions. This particularly involves the International Atomic Energy Agency (IAEA) and the World Association of Nuclear Operators (WANO) missions as well as nuclear safety assessment from assessment within the framework of accession of the Czech Republic to the European Union through the group established at the Atomic Question Group (AQG) up to the assessment according to the European Nuclear Safety Regulators Group (ENSREG) specification in the framework of Stress Tests, review of safety margins of NPPs, carried out in response to the event that occurred at the Fukushima Daiichi NPP.

The IAEA missions compare the safety level achieved with the IAEA recommendations and international practice in the area in question. The conclusions of the missions contain a set of recommendations and suggestions for further safety enhancement. The WANO missions indicate mainly the areas of "good practice", where the applied approach exceeds the current practice.

Following the requirements imposed by the Vienna Declaration on Nuclear Safety (VDNS), the assessments carried out are further analysed. (The issues of satisfying the VDNS requirement for new nuclear units are addressed in Chapter 18.)

6.2 Safety assessment of nuclear installations

Safety assessment of nuclear installations is carried out in several independent ways, which include continued and periodic assessment of nuclear and technical safety (see Chapter 14.1.2, deterministic nuclear safety assessment – see Chapter 14.1.2, probabilistic nuclear safety assessment – see Chapter 14.1.2, benchmarking; Chapter 13.4, international missions (OSART, WANO – see below and Annex 7).

Based on these assessments, measures are adopted to enhance the safety of nuclear installations – e.g., the National Action Plan (see Annex 3), implementation of the Accident Management (see Chapter 19.4), Plans for Safety Enhancement.

The Plans for Safety Enhancement of nuclear power plants are the documents encompassing safety-related modifications/projects. These plans are updated each year, considering the inputs from PSR, internal and external feedback, international missions, benchmarking, national legislation, LTO, PSA, and other sources (see Annex 4).

Following the experience of other nuclear installations and energy companies, the IAEA initiated the review of the "management for safety" in the form of the so-called "Operational Safety Review Team (OSART) Corporate". The first review of this topic took place in the Czech Republic in September 2013 and details of this review are part of the National Report of the Czech Republic of 2016.

In addition, the WANO launched peer reviews at the corporate level. The first WANO Corporate mission with the licence holder ČEZ, a. s., was held in May 2017. A team of experts assessed the cooperation between the central units and the Temelín and Dukovany Nuclear Power Plants in the following areas:

- Corporate leadership;
- Corporate governance;
- Corporate oversight and monitoring;
- Corporate independent oversight;
- Corporate support and performance;
- Corporate human resources;
- Corporate communication.

There have been identified two strengths:

- establishment of the "Design Authority" unit,
- ability to use modern media (social networks, surveys, internal and external communication, online conversations with employees or popularizing events – e.g. philharmonic concert in the cooling tower of the Temelín NPP) for the education and communication with people,

and two areas for improvement:

- corporate leadership (ability to formulate strategic specifications, maintain and develop relationships with employees, to be able to convince the subordinates of the correctness of decisions or get things done etc.),
- strengthening the corporate supervision; the reporting system in the company is not set to support the improvement process or enable early intervention in case of recognizing negative trends,

which are implemented in the management system of the licence holder, ČEZ, a. s.

(Other information on the assessment carried out is presented in Chapter 14 and information on the measures resulting from the findings of those assessments is provided in Chapter 18. Information on the significant events that occurred at the Dukovany NPP and the Temelín NPP in the past three years can be found in Chapter 6.4.)

6.3 International safety assessments

The international missions listed below have been conducted with the licence holder over the past three years. An exhaustive list of all the missions, which have been described in previous reports, can be found in Annex 7.

6.3.1 IAEA TSR (Technical Safety Review) PSA (Dukovany NPP), 2016

The objective of the mission [6.1], formerly called the International Probabilistic Safety Assessment Review Team (IPSART), is to improve the quality of PSA and Safety Monitor models and increase their suitability for risk-informed applications (e.g., “online maintenance” for “Limits and Conditions”, etc.). Compared to “traditional inspection missions (e.g. WANO, OSART), the objective is to receive as many comments as possible but:

- valid, factual and correct,
- with impacts on the results of analyses,
- improving generally the quality of models,
- improving the quality of documentation for the individual areas of PSA,
- increasing the applicability and appropriateness of probabilistic models to risk-informed applications such as “online maintenance” or the “risk-informed” approach to the Limits and Conditions, etc.

A significant part of the TSR PSA mission focused on topics that were identified by ČEZ, a. s., and ÚJV a. s., specialists in the past in the preparation of proposals for updating the PSA analyses for the Dukovany NPP, for example:

- improve the clarity of PSA documentation at selected points,
- assess the suitability of updating the criteria for quantitative screening (seismic, internal floods, fires etc.) and revise screening in selected areas,
- consider adding the description and results of the sensitivity analysis to the summary report on PSA,
- add more detailed models of selected parts of the scenarios of the response to the initiation event - turbo-generator isolation, OVKO (pressure-relief valve of pressuriser), loss-of-coolant accident (LOCA), etc.,
- revise/update the analysis of seismic risk, risk of internal fires, floods, external hazards, etc., using the latest methodologies and new data sources.

6.3.2 SALTO Peer Review Follow-up (Dukovany NPP), 2016

In November 2016, the follow-up review was held to examine how the recommendations (2) and suggestions (6) of the Safe Long Term Operation (SALTO) mission of 2014 [6.2] were addressed.

The team found that five suggestions for the mission were resolved, with the solution to the last one showing sufficient progress. One recommendation of the mission was resolved and one shows sufficient progress in the solution.

6.3.3 WANO Peer Review (Dukovany NPP), 2017

In the period from March to April 2017, the WANO mission was held in the Dukovany NPP fully under the new performance objectives and criteria [6.3]. The power plant was evaluated by the areas divided into three main groups:

- foundations (nuclear professionals, leadership),
- functional areas (operation, maintenance, chemistry, engineering, radiation protection, training),
- cross-functional areas (operational focus, work management, equipment reliability, configuration management, radiological safety, performance improvement, operating experience, organisation effectiveness, fire protection, emergency preparedness).

The WANO team identified only nine areas for improvement in functional (operation, maintenance, chemistry, engineering, radiological protection) and cross-functional areas (performance improvement, organizational effectiveness, fire protection). In addition, two strengths (new analytical techniques for the determination of lubricant impurity, database of protected areas with equipment for fire alarms and a sprinkler system).

6.3.4 Follow – up WANO PEER REVIEW (Temelín NPP), 2017

The review aimed to determine the effectiveness of the corrective actions taken in response to 14 areas for improvement identified during the peer review in 2015 and on the efforts to enhance the safety and quality of performance of the power plant [6.4].

Assessment of the state of areas for improvement (AFI) during the mission:

Satisfactory (Level A): Evidence shows substantial performance improvement has been achieved.	6
On track (Level B): Evidence shows that performance has begun to improve but some performance gaps remain.	6
At risk (Level C): No or little performance improvement has been achieved.	2
Unsatisfactory (Level D): Performance continues to be unsatisfactory.	0

6.3.5 Follow – up WANO PEER REVIEW (Dukovany NPP), 2019

The review aimed to determine the effectiveness of the corrective actions taken in response to nine areas for improvement identified during the peer review in 2017 and on the efforts to enhance the safety and quality of performance of the power plant [6.4].

Assessment of the state of areas for improvement during the mission:

Satisfactory / completed (Level A): Acceptable performance is now demonstrated.	2
On Track (Level B): Evidence shows that substantial, demonstrated performance improvement has been achieved. Additional run time may be needed to demonstrate solid performance is sustainable. Indicators and oversight are in place to monitor and promote continued improvement.	7
At risk (Level C): Evidence shows that performance may have begun to improve, but performance gaps remain, and insufficient measurable performance improvement has been achieved. A repeat AFI may result without additional attention.	0
Unsatisfactory (Level D): Even if there has been some improvement, overall performance continues to be unsatisfactory. Sufficient effort to resolve the weakness has not been applied, and additional management attention is required. A repeat AFI is likely in the next peer review unless an effective recovery plan is implemented.	0

6.3.6 WANO Peer Review (Dukovany NPP), 2021

In the period from April to May 2021, the WANO mission was held in the Dukovany NPP under the innovative performance objectives and criteria for 2019-1 [6.3]. The power plant was evaluated by the areas divided into seven groups:

- foundations (safety culture, nuclear professionals, leadership fundamentals),
- effective organisation (organisation effectiveness, integrated risk management),
- learning organisation (performance improvement, operating experience, training, human performance),

- power plant operation (operation, operational focus, work management, maintenance, chemistry),
- power plant operation (operation, operational focus, work management, maintenance, chemistry),
- equipment performance (engineering, equipment reliability, nuclear fuels, configuration management, project management),
- safety and protection (fire safety, fire protection, radiological safety, radiological protection, industrial safety, emergency preparedness and severe accident management),
- management areas of the company headquarters (corporate areas).

The WANO team identified 9 areas for improvement (leadership foundations, integrated risk management, performance improvement, human performance, operation management, operational priorities, maintenance, long-term equipment reliability and radiation safety). It also identified three strengths (training - integrated approach to recruiting, implementation of radiation protection - cleaning of radioactive wastewater tanks, leadership for emergency preparedness and severe accidents - alternative emergency control centre).

6.3.7 WANO Peer Review (Temelín NPP), 2019

The WANO mission took place at the Temelín NPP in August.

The power plant was evaluated by the areas divided into three main groups:

- foundations (nuclear professionals, leadership),
- functional areas (operation, maintenance, chemistry, engineering, radiation protection, training),
- cross-functional areas (operational focus, work management, equipment reliability, configuration management, radiological safety, performance improvement, operating experience, organisation effectiveness, fire protection, emergency preparedness).

The WANO team identified nine areas for improvement in following areas: nuclear professionals, leadership, risk management, performance improvement, maintenance, engineering, operation and work management).

6.3.8 WANO Peer Review Follow-up (Temelín NPP), 2021

The follow-up mission took place in February 2021 and was aimed to determine the effectiveness of the corrective actions taken in response to nine areas for improvement identified during the peer review in 2019 and on the efforts to enhance the safety and quality of performance of the power plant.

Assessment of the state of areas for improvement during the mission:

Satisfactory (Level A): Evidence shows that actions taken have resolved the AFI and satisfactory performancehas been achieved.	1
On Track (Level B): Evidence shows that performance improvement has taken place, but some gaps remain. Remaining actions are expected to fully resolve the AFI.	8
At risk (Level C): Evidence shows that performance may have begun to improve, but performance gaps remain, and insufficient measurable performance improvement has been achieved.	2
Unsatisfactory (Level D): Evidence shows little or no performance improvement has been achieved.	0

6.3.9 IPPAS mission, 2021

The International Physical Protection Advisory Service (IPPAS) mission took place in the Czech Republic from 8 to 19 November 2021. The mission aimed to independently verify the level of the national security regime for nuclear installations and nuclear materials in the Czech Republic under the Convention on the Physical Protection of Nuclear Material. The mission aimed to review the Czech legal and regulatory framework for the physical protection of nuclear material, nuclear installations and associated activities. The IPPAS team also reviewed the information and computer security measures; regulatory procedures for granting licences, inspections, and enforcement; coordination between stakeholders involved in nuclear security; and the interface between nuclear material accountancy and control and nuclear safety.

The mission was carried out by a team composed of international IAEA experts. In addition to the SÚJB, representatives of other competent ministries and governmental organisations, including the National Security Authority, the National Cyber and Information Security Agency, the Police of the Czech Republic, and representatives of ČEZ, a. s., took part during the IPPAS mission.

The following modules were reviewed:

- Module 1 – evaluation of the national security regime for nuclear installations and nuclear materials,
- Module 2 – assessment of the security level of nuclear installations,
- Module 3 – assessment of the security level of nuclear material transfers, and
- Module 5 – cyber security.

As part of Module 2, the IPPAS team visited the Dukovany and Temelín Nuclear Power Plants, as well as the Temelín Spent Nuclear Fuel Storage.

During the mission, no serious deficiencies were found in the physical protection system in the Czech Republic. The final evaluation contains 5 recommendations and 12 proposals for improvement of the level of security of nuclear installations and nuclear materials in the Czech Republic and identified 17 examples of good practice. In conclusion, the IPPAS team stated that the Czech Republic has an advanced and well-established nuclear security regime, which has been constantly improving in recent years.

6.3.10 SEED IAEA mission

In the period from 16 to 20 May 2022, the IAEA mission “External Events Safety Section (EEDD) Site and External Events Design (SEED) Review Mission on Seismic Hazard at Temelín NPP and Dukovany NPP sites” (hereinafter referred to as the “SEED Mission”) will take place. This mission is organised as a joint mission for Temelín NPP and Dukovany NPP and is organisationally divided into two parts. The first part will take place as a follow-up mission for Temelín NPP (previous missions took place in 2003 and 2013) and the second part as the first mission for Dukovany NPP.

The objectives of the joint SEED mission are as follows:

1. check the reliability of seismic hazard assessment methods used for the Temelín NPP and Dukovany NPP sites,
2. evaluate the measures following the problems identified by the expert mission conducted in 2013 in the Temelín NPP site,
3. evaluate updated seismic hazard studies conducted in the last decade for Temelín NPP and Dukovany NPP,

based on current international practice and IAEA recommendations.

Data related to seismic hazard assessment were updated and collected for this mission in the years 2019 – 2021. A new Probabilistic Seismic Hazard Assessment (PSHA) calculation was performed for the area for the siting of both power plants.

The IRRS missions and their conclusions are described in Chapter 8.2.4.

6.4 Statement on the continued operation

Continued and periodic safety reviews, conducted by the licence holder and external entities, show that the level of safety in the practice of the nuclear power plants currently in operation in the Czech Republic meets the high safety standards.

The new legislation entered into force in 2017 and incorporated Council Directive 2009/71/EURATOM of 25 June 2009 as amended by Council Directive 2014/87/EURATOM, establishing a Community framework for the nuclear safety of nuclear installations and other principles corresponding to the world good practice. It contains the requirement for practical elimination of such an early radiation accident and radiation emergency that will not allow for local or time restrictions for the immediate measures imposed. This requirement is also applied to currently operated units to a practicable extent.

6.5 Overview of significant operational events at NPP and measures implemented to address them and prevent their recurrence

6.5.1 Dukovany Nuclear Power Plant

No event rated International Nuclear Event Scale (INES) 1 or higher occurred in the Dukovany Nuclear Power Plant during the period concerned from 2016 to February 2019.

Violation of the Limits and Conditions due to non-design condition of the secondary seal of MCP flange

During the leakage test of the intermediate space of the seal of the main circulation pump (MCP) flange on Dukovany NPP Unit 1 on March 30, 2017, a leak through the secondary flanges of MCP was detected. The purpose of this seal is to create a pressure drop for signalling leakage of the primary seal. The secondary seal was originally fitted with an asbestos rope, which was replaced with a rope made of an unsuitable material due to the prohibition of the use of asbestos products. The cause of leakage of the intermediate space of the MCP flange is the degradation of secondary seal due to the effect of operating temperature and long-term effects of radiation at the place of installation of the seal, already during the first operational campaign of the seal.

The event was addressed by gradually replacing with the graphite seals always when removing the MCP for periodic inspection and was completed in 2020.

Damage to diesel-generator piston during the ELS (Emergency Load Sequencer) test

Diesel generators (DG) supply the safety-relevant systems in the event of loss of off-site power. During the Emergency Load Sequencer (ELS) test on December 28, 2017, which is performed to verify the ability of the power plant to respond to the loss of power, one of the diesel-generator pistons was destroyed during the operation of the diesel generator. After test interruption and piston removal, it was found that the cooling ring of the piston was damaged to the extent of making its repair impossible. Unsuitable material and technological treatment of the cooling ring was identified as the cause of damage.

The event was resolved by complete repair of the piston mechanism, exchange of DG oil and the introduction of the program for monitoring the quality of the affected spare parts. Furthermore, a procedure was proposed for non-destructive testing of the internal parts of the DG during its inspections.

In the second period in question, i.e., from March 2019 to February 2022, four events rated INES 1 and no event with a higher rating occurred at the Dukovany Nuclear Power Plant.

Leaking welded joint under the safety valve in the primary circuit caused by system vibration.

During the unsuccessful pressure test on Unit 3 before the start-up after shutdown, there was a leak in the welded joint under the safety valve in the primary circuit. Unsealing was caused by system vibration due to safety valve locking failure. Locking is made to perform a pressure test to prevent the safety valve from opening.

The event was resolved by a change in the construction and method of locking the safety valves in the primary circuit.

Violation of the Limits and Conditions due to failure to perform the required actions in the event of DG failure

Diesel generators supply the safety-relevant systems in the event of loss of off-site power. Incorrect operability assessment of diesel-generator, in the event of failure caused by cracking in the valve seat of the exhaust section, led to the violation of the Limits and Conditions due to the impact of the human factor. Neither diesel generator manufacturers nor independent laboratories have been able to determine the cause of cracking in the valve seat.

The event was resolved by repairing the diesel generator, improving the diagnostics of similar defects, and adjusting the operability assessment.

Discrepancy between material certificates and the actual quality of metallurgical material

Based on notice of the maintenance supplier, it was found that the supplied metallurgical material used for maintenance and modifications does not always have the properties declared in the certificates supplied. The identified cause was insufficient customer inspection settings in metallurgical material verification. Furthermore, the cause was determined in the insufficient setting of the system of work with the results of random inspections of metallurgical materials and the system of blocking non-conforming metallurgical material.

The event was resolved by strengthening the quality of customer inspections, setting up the system of inspections and applying their results.

Violation of the Limits and Conditions due to failure to perform the required actions in the event of penetration of cooling water into bearing oil of high-pressure feedwater pump

The high-pressure feedwater pump is designed to deal with the loss of reactor coolant accidents. Incorrect operability assessment of the pump in the case of penetration of cooling water into bearing oil caused by cracking in bearing housing led to the violation of the Limits and Conditions due to the impact of the human factor. The cause of cracking in bearing housing is probably corrosion in combination with a manufacturing defect. Shortcomings in the conservative approach and use of operating experience are the cause of incorrect operability assessment.

The event is solved by protecting bearing housings against corrosion and repairing small cracks, introducing a system of regular training in correct assessment of operability and adjusting the system of transferring operating experience within the operating staff.

6.5.2 Temelín Nuclear Power Plant

One event rated INES 1, as described below, and no event rated higher than INES 1 occurred in the Temelín Nuclear Power Plant during the period concerned from 2016 to February 2019.

Leakage of the non-essential service water line associated with violation of the Limits and Conditions for tightness of localization groups

On November 6, 2018, there was a contact within the reassembly of insulation with the non-essential service water pipeline, passing through the containment wall in the space between quick-acting valves, intended to separate the containment from the external environment. This situation was reported by workers and addressed by temporarily sealing with a sleeve. However, reduced operability of the localization group was retrospectively evaluated the next day. The appropriate limiting condition for the operation has been retrospectively applied, leading to the initiation of a gradual power decrease.

During this operation, the rate of leakage from the containment has been calculated according to the requirements of the Limits and Conditions, which demonstrated that the rate of leakage from the containment does not exceed the limit value. This terminated the event.

Rating the event as INES 1 is the result of a leak and poor identification of the impacts of this leak on the Limits and Conditions for operation, leading subsequently to their violation. The condition of the equipment when the heterogeneous welded joint failed and the human factor when the head of the reactor unit failed to use technical diagrams or any other suitable source of information to validate the impacts of the leak were identified as the root causes of the event.

In the period from March 2019 to February 2022, two events rated INES 1 and no event with a rating higher than INES 1 occurred at the Temelín Nuclear Power Plant.

HVB1 failure due to RCLS failure, violation of the Limits and Conditions

On 15 May 2020 at 12:46 a.m., the reactor on Unit 1 (HVB1) was shut down due to the limiting signal LSd from 80 % power. The cause was a fault in the RCLS (reactor control and limitation system, faulty communication on one of the two buses of the HWY1 system) and a false signal to shut down the LSd reactor generated in this fault, for which there was no technological reason. During the stabilization of the unit, some components controlled by the RCLS were repeatedly uncontrollable, equipment failures occurred repeatedly, and physically meaningless values of parameters from the RCLS were displayed.

During the event, the reactor was shut down and subsequently, the required activities were not performed within the specified time of implementation, thus violating the Limits and Conditions. The event was rated INES 1, considering the safety culture assessment.

To prevent the event from recurring, new RCLS resilience software was tested and installed on both main production units. Furthermore, the interface of the control system was modified, and new procedures and training programs for the management of events of a similar type were created.

Discrepancy between material certificates and the actual quality of metallurgical material

This event is identical to the one described above for the Dukovany NPP.

6.6 Overview of planned activities performed to enhance nuclear safety

For principles of creation and content of the Plans for Safety Enhancement of licence holder, see Annex 4.

Establishment of the vital areas

In terms of security, a modification of the physical protection system of ETE and EDU is completed as of the date of issue of this report, in the form of establishing the so-called “vital areas”. The requirement for the establishment of vital areas is set out in the Atomic Act and is based on the IAEA recommendation of the document NSS No. 13. The vital areas are defined in the implementing Decree No. 361/2016 Coll., on security of nuclear installation and nuclear material, following Section 161(4) of the Atomic Act, as areas in which the systems are located, damage of which can result in a radiation accident. An example of such areas is main control rooms, diesel generator buildings, and essential service water pumping stations. To delineate these areas, new mechanical barriers were created at the boundary of these areas and an additional level of the control of the entry of persons into these areas is provided.

The first stage of the implementation of vital areas was completed – e.g., for main and emergency control rooms, security systems, etc. Along with the implementation, the technical system of physical protection was renovated – new entrance turnstiles, new higher fences separating individual protected areas, sensor and camera innovations. The physical protection control centre was fully modernised.

In the second stage of the establishment of vital areas, the implementation of technical measures at system diesel generator stations and for essential service water pumps is in progress. This stage will be completed in 2022.

The first stage of the implementation of vital areas was successfully completed - e.g. for main and emergency control rooms, security systems, etc. Along with the implementation, the technical system of physical protection was renovated - new entrance turnstiles, new higher fences separating individual protected areas, sensor and camera innovations. The physical protection control centre was fully modernized.

In the second stage of the establishment of vital areas, the implementation of technical measures at system diesel generator stations and for essential service water pumps is in progress. This stage will be completed in 2022.

Case of Welds

As stated in the previous National Report (Annex 4, Part 3 Measures), one of the requirements resulting from the case "Welds" is the creation of sufficient human resources needed for the implementation and evaluation of non-destructive testing in the case of work performed by contractors to ensure human resources for supervision. While fulfilling this requirement, the holder of a licence for the operation of nuclear installations in the Czech Republic decided to establish, from its resources, a new centre for education, training and certification for staff involved in welding and non-destructive testing.

A new training and implementation centre has been in operation since 2019. The centre is situated in the Temelín site and is intended for training for welding staff of both power plants, welding training for major repairs and the associated qualification of persons, qualification of repair procedures, ensuring of inspection welded joints, the performance of operating tests and also for training for staff involved in technical inspections intended for the performance and provision of the inspections of equipment, piping systems and components of nuclear and conventional power plants. These trainings are provided by employees of the licence holder.

Other significant planned activities

A list of the most important planned activities follows. The list of significant measures to increase safety is updated in the Plans on Strengthening Safety at Dukovany NPP and Temelín NPP (see Annex 4) on an annual basis:

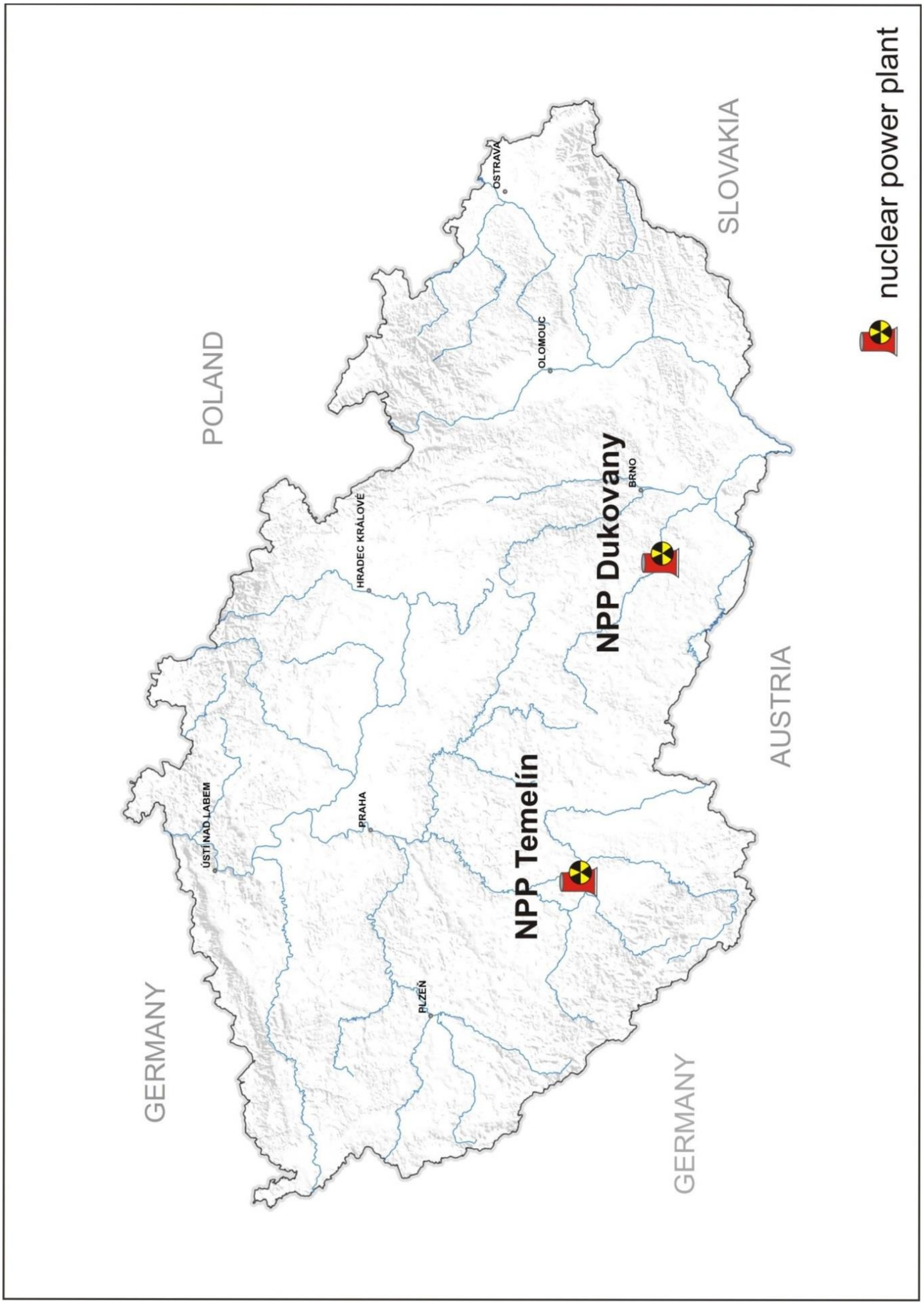
- overhaul of Velan fast-acting valves (EDU),
- modifications to protect the integrity of the hermetic zone and support hydrogen recombiners (EDU),
- updating of the model for Safety Monitor (ETE),
- measures to increase the robustness of the units to better manage the consequences of potential severe accidents (ETE),

- addition of stable fire extinguishing equipment for the turbogenerator and turbochargers to increase the fire safety of the turbine building (ETE).

Statement on the implementation of the obligations concerning Article 6 of the Convention

All the above-mentioned studies and analyses positive prove that the level of nuclear safety provision at Dukovany NPP and Temelín NPP units is high and in compliance not only with current requirements valid in the Czech Republic but also with internationally accepted practices. The nuclear safety status has been systematically reviewed and evaluated from the viewpoint of the latest scientific and technical knowledge. Necessary activities are planned and implemented so that the current status is maintained or further improved in the future. The requirements resulting from Article 6 of the Convention are fulfilled.

Fig. 6-1 Map of the Czech Republic indicating the positions of the Temelín and Dukovany NPPs



7. LEGISLATIVE AND REGULATORY FRAMEWORK

1. Each contracting party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.

2. The legislative and regulatory framework shall provide for:

(i) the establishment of applicable national safety requirements and regulations;

(ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence;

(iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;

(iv) the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

7.1 Legislative and regulatory framework

7.1.1 Atomic Act

The Atomic Act defines conditions for the peaceful utilization of nuclear energy and ionising radiation, including the activities requiring a SÚJB licence. It gives the responsibility for governmental administration and management to the SÚJB, and defines its power and competency.

Atomic Act – Act No. 263/2016 Coll., was approved by the Parliament of the Czech Republic on July 14, 2016, and has entered into force on January 1, 2017. Its preparation has not been primarily driven by the need to set up completely new legal relationships, but rather to supplement and particularly refine existing legislation based on experience gained over nearly two decades of application of previous legislation– Act No. 18/1997 Coll., on Peaceful Utilisation of Nuclear Energy and Ionising Radiation (the Atomic Act) and on Amendments and Additions to Related Acts, and the new recommendations of international institutions and other new findings. The new Atomic Act replaced previous Act No. 18/1997 Coll., in all its parts, except to the regulation of civil liability for nuclear damage.

The Atomic Act respects all changes presented both at the international level and within the Euratom. In addition to individual IAEA recommendations, these are, for example, Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations and Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom, and 2003/122/Euratom.

The Atomic Act establishes activities for which a licence issued by the SÚJB is required. Besides the main licences for the siting, construction, operation, and decommissioning of a nuclear installation, many more licences are concerned (see Chapter 7.2.2).

In the area of radioactive waste management, already Act No. 18/1997 Coll., entrusted responsibility for the final disposal of all radioactive waste to the state and ordered the Ministry of Industry and Trade of the Czech Republic to establish a new governmental organization for the purpose – the Radioactive Waste Repository Authority. The Atomic Act takes over this concept. Pursuant to Act No. 219/2000 Coll., on the Property of the Czech Republic and Its Representation in Legal Relations, the SÚRAO is a governmental organization. Activities of the Radioactive Waste Repository Authority are funded from the so-called “nuclear account” whose main income is represented by payments from radioactive waste producers.

Act No. 18/1997 Coll. transforms the obligations resulting from the Vienna Convention on Civil Liability for Nuclear Damage and Joint Protocol relating to the Application of the Vienna and Paris Conventions, to which the Czech Republic acceded, into the Czech legal system.

7.1.2 Related legislation

Other important laws related to this area are (all as amended):

- Act No. 2/1969 Coll., on the Establishment of Ministries and Other Central Government Authorities of the Czech Republic.
- Act No. 505/1990 Coll., on Metrology.
- Act No. 18/1997 Coll., on Peaceful Utilisation of Nuclear Energy and Ionising Radiation (the Atomic Act) and on Amendments and Additions to Related Acts.
- Act No. 22/1997 Coll., on Technical Requirements for Products and on Amendment to Certain Related Acts.
- Act No. 123/1998 Coll., on the Right to Information on the Environment.
- Act No. 106/1999 Coll., on Free Access to Information.
- Act No. 239/2000 Coll., on Integrated Rescue System and on Amendment to Certain Related Acts.
- Act No. 240/2000 Coll., on Crisis Management and on Amendment to Certain Related Acts (Crisis Act).
- Act No. 100/2001 Coll., on Environmental Impact Assessment and on Amendment to Certain Related Acts (the Act on Environmental Impact Assessment).
- Act No. 500/2004 Coll., Administrative Code.
- Act No. 634/2004 Coll., on Administrative Fees.
- Act No. 412/2005 Coll., on the Protection of Classified Information and on Security Capacity.
- Act No. 183/2006 Coll., on Town and Country Planning and Building Code (Building Act); *(note: Act No. 283/2021 Coll., on Town and Country Planning and Building Code (Building Act) will enter into force on July 1, 2023)*
- Act No. 372/2011 Coll., on Medical Services and Conditions for their Provision (Act on Health Services).
- Act No. 373/2011 Coll., on Specific Medical Services.
- Act No. 255/2012 Coll., on Inspection (Inspection Code).

7.1.3 Multilateral international treaties and treaties with IAEA

Part of applicable legislation in the given area includes the following international treaties binding to the Czech Republic (or the predecessor of the Czech Republic, the former Czechoslovak Socialistic Republic and later the Czech and Slovak Federal Republic):

- Convention on the Physical Protection of Nuclear Materials (in Vienna on October 26, 1979, Supplement July 8, 2005, declared under No. 114/1996 Coll., No. 27/2007 Coll., and under No. 64/2016 Coll.).
- Convention on Early Notification of a Nuclear Accident (in Vienna on September 26, 1986, declared under No. 116/1996 Coll.).
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (in Vienna on September 26, 1986, declared under No. 115/1996 Coll.).

- Nuclear Safety Convention (in Vienna on June 17, 1994, declared under No. 67/1998 Coll.).
- Vienna Convention on Civil Liability for Nuclear Damage (in Vienna on May 21, 1963, declared under No. 133/1994 Coll., adjusted by Communication of the Ministry of Foreign Affairs No. 125/2000 Coll.) and amended by Protocol of 1997.
- Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (in Vienna in 1988, declared under No. 133/1994 Coll.).
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (in Vienna on September 29, 1997, declared under No. 3/2012 Coll.).
- Treaty on the Non-Proliferation of Nuclear Weapons (NPT), (in Moscow, Washington, London, on March 29, 1974, declared under No. 61/1974 Coll.).
- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, February 25, 1991, Supplements February 27, 2001 and June 4, 2004, declared under No. 91/2001 Coll., No. 27/2015 Coll., and No. 70/2017 Coll.).
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus, on June 25, 1998, declared under No. 124/2004 Coll.).
- Convention on Korean Energetics Development Organization and the Protocol supplementing the Convention on Korean Energetics Development Organization (New York, March 9, 1995, declared under No. 27/2001 Coll.).
- Agreement between the Czech Republic and the International Atomic Energy Agency on Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons (in Vienna on September 18, 1996, declared under No. 68/1998 Coll.).
- Supplemental Protocol to the Agreement between the Czech Republic and the International Atomic Energy Agency on Safeguards, based on the Treaty on Non-proliferation of Nuclear Weapons (in Vienna on September 28, 1999, declared under No. 74/2003 Coll.).
- Adapted supplemental Agreement on Technical Assistance provided by the International Atomic Energy Agency to Government of the Czech and Slovak Federal Republic (in Vienna on September 20, 1990, declared under No. 509/1990 Coll.).
- International Labour Organization Convention No. 115 Concerning the Protection of Workers Against Ionising Radiation (Geneva, June 22, 1960, declared under No. 465/1990 Coll.).
- Comprehensive Nuclear Test Ban Treaty (New York, September 10. 1996, entered into force, signed by the Czech Republic on November 12, 1996 and ratified on September 11, 1997).
- Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage – in Vienna on September 12, 1997, signed by the Czech Republic on June 18, 1998, however it has not yet been ratified). By virtue of Act No. 158/2009 Coll., the Czech Republic adapted the amount of liability of the operators and state guarantees to this protocol.
- Convention on Supplementary Compensation for Nuclear Damage – in Vienna on September 12, 1997, the Government Order No. 97/1998, signed by the Czech Republic, however has not been ratified yet).

The obligation to inform about significant events relating to nuclear safety is also established in the bilateral agreements entered by the Czech Republic or its predecessors.

7.1.4 Bilateral cooperation with neighbouring States

The bilateral cooperation with neighbouring States is concluded:

- With the Slovak Republic (Agreement between the Government of the Czech Republic and the Government of the Slovak Republic on Cooperation in the Field of State Supervision of Nuclear

Safety of Nuclear Installations and State Supervision of Nuclear Material). The cooperation is mainly carried out in the form of consultations over specific problems at the level of inspectors and workers of different management levels; joint inspections at selected installations are also organized on regularly and annual meetings are held.

- With the Republic of Poland (Agreement between the Czech Republic and the Government of the Republic of Poland on Early Notification of a Nuclear Accident and on Exchange of Information on Peaceful Uses of Nuclear Energy, Nuclear Safety and Radiation Protection), where a two-year cycle of periodic meetings between the representative of both Parties takes place.
- With the Federal Republic of Germany (Agreement between the Government of the Czechoslovak Socialist Republic and the Government of the Federal Republic of Germany to Settle Issues of Common Interest in Connection with Nuclear Safety and Radiation Protection).
- With the Republic of Austria (Agreement between the Government of the Czech Republic and the Government of the Republic of Austria to Settle Issues of Common Interest in Connection with Nuclear Safety and Radiation Protection).

Following bilateral intergovernmental agreements concluded with the Federal Republic of Germany and with the Republic of Austria, the Czech Republic submits to the regulatory bodies of these countries information on its nuclear installations in border regions. Information is transferred regularly, at periodic bilateral annual meetings, and irregularly, within the agreed meetings, or in writing.

7.2 Other requirements and frameworks

7.2.1 Implementing legislation and safety guides

Implementing legal regulations

The Atomic Act authorizes the SÚJB, and in strictly defined cases other bodies of the state administration, to issue a set of related implementing regulations, an exhaustive list of which can be found in Annex 1. They include but are not limited to the following regulations, which are mentioned in the text below:

- ***Decree No. 358/2016 Coll.,*** on requirements for assurance of quality and technical safety and assessment and verification of conformity of selected equipment.
- ***Decree No. 359/2016 Coll***., on details of ensuring radiation extraordinary event management.
- ***Decree No. 360/2016 Coll.,*** on radiation situation monitoring.
- ***Decree No. 361/2016 Coll.,*** on security of nuclear installation and nuclear material.
- ***Decree No. 378/2016 Coll.,*** on siting of a nuclear installation.
- ***Decree No. 408/2016 Coll***., on management system requirements.
- ***Decree No. 409/2016 Coll.,*** on activities especially important from nuclear safety and radiation protection viewpoint, special professional qualification and training of persons ensuring radiation protection of the registrant.
- ***Decree No. 422/2016 Coll***., on radiation protection and security of a radioactive source.
- ***Decree No. 21/2017 Coll.,*** on ensuring nuclear safety of a nuclear installation.
- ***Decree No. 162/2017 Coll.,*** on requirements for safety assessment pursuant to the Atomic Act.
- ***Decree No. 329/2017 Coll.***, on the requirements for nuclear installation design.

A complete text of the Atomic Act and its implementing legal regulations is available on the SÚJB website[1].

Safety guides and recommendations

The legal framework in the broader sense is closed by the series of safety guides and recommendations, which play the role of the recommended best practice to meet the legal requirements.

A total of 55 documents (guidelines, translations of IAEA recommendations, etc.) were issued by the SÚJB between 1994 and 2007. The follow-up stage was the preparation of new or amendment of older guidelines aimed at incorporating the requirements of the Western Nuclear Regulatory Association (WENRA) reference levels, which was completed in 2010. After this period, they were mainly subjected to amendments.

In connection with the new Atomic Act and its implementing legislation, the complete review and revision of all existing safety guides and recommendations have been underway since 2017. The set of safety guides is focused mainly on the following areas: management system, quality assurance, education and training of nuclear power plant personnel, requirements for the design of nuclear installation, safety classification of structures, components and systems of the nuclear installations, limits and conditions of safe operation, PSA, PSR, operating experience and feedback, maintenance, inspection and testing of equipment, component ageing management, fire protection, abnormal and severe accident management, external risks, safety culture, and more.

Even regarding the fact that the preparation of safety guides and recommendations is a continuous process, the planned number and scope of safety guides and recommendations, which was launched in connection with the adoption of the new Atomic Act, is now completed. This process will be completed by the end of this year.

Safety guides are drawn up by teams composed of the SÚJB staff and its TSO, often with the technical assistance of other external specialists in the given area and cooperation with the SÚJB legal department. The process of creating documents is governed by the SÚJB Legislative Work Plan, which is approved and supplemented at meetings of the SÚJB management. To support their creation, the guideline "VDS 045 Rules for Managed Documents" was issued. Stakeholder comments and feedback from operating experience are considering in their creation.

Safety guides and recommendations are published on the SÚJB website[2]; they are prepared in consultation with the professional public, with the licensee being allowed to make its comments. Even after their issuance, any comments a recollected, which serve as one of the supporting documents for deciding on another revision, or on issuing a new safety guide.

7.2.2 System of licensing

The Atomic Act regulates the method of peaceful use of nuclear energy and ionising radiation and the conditions for the performance of activities related to the use of nuclear energy, activities in exposure situations, activities in the field of radioactive waste management, carriage of radioactive or fissile materials, activities in the area of non-proliferation of nuclear weapons and other activities important for ensuring nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security. A precondition for the performance of such activities is the licence issued by the SÚJB within an administrative procedure independent of the other administrative procedures including the procedure required under the Building Act.

[1] www.sujb.cz/en/legal-framework

[2] www.sujb.cz/en/reports

Approvals of the state authorities include, in addition to a licence for the siting, construction and operation, several other separate licences issued by the SÚJB under Section 9 of the Atomic Act in various stages of the life cycle of a nuclear installation, specifically the following:

According to Section 9(1) of the Atomic Act, a licence shall be required for performing the following activities:

- the siting of a nuclear installation,
- the construction of a nuclear installation,
- the first physical start-up of a nuclear installation with a nuclear reactor,
- the first power-generation start-up of a nuclear installation with a nuclear reactor,
- the commissioning of a nuclear installation without a nuclear reactor,
- the operation of a nuclear installation,
- the individual phases of decommissioning of a nuclear installation, and
- the carrying out of modifications affecting nuclear safety, technical safety, and physical protection of a nuclear installation.

Pursuant to Section 9(6) of the Atomic Act, a licence shall be also required for:

a) training and further training of workers performing activities of particular relevance to nuclear safety and radiation protection (hereinafter "selected worker"), and
b) training of a natural person ensuring the radiation protection of a person who has been registered under this Act (hereinafter the "registered person").

In addition, the Atomic Act regulates other licences, i.e.:

- for the activities in exposure situations (Section 9(2)),
- for the activities in the area of radioactive waste management (Section 9(3)),
- for carriage of radioactive or fissile materials (Section 9(4)),
- for the activities in the area of non-proliferation of nuclear weapons (Section 9(5),
- for complete decommissioning (Section 9(7)).

Other provisions of the Atomic Act regulate:

- Good repute (Section 14),
- Professional competence (Section 15),
- Licence application (Section 16),
- Procedure for issuing licences (Section 19),
- Particulars and period of validity of a licence (Section 21),
- New decision on the issue of a licence and cancellation and lapse of a licence (Section 22),
- Documentation for a licensed activity and its amendment (Section 24).

Besides the above-mentioned Atomic Act, another legal standard regulating the licensing procedure for nuclear installations is Act No. 183/2006 Coll., on Town and Country Planning and Building Code (Building Act), which entered into force on 1 January 2007.

In the case of construction within the area of a nuclear installation, the Building Act sets out a three-stage procedure for its licensing (site decision, construction permit and final inspection approval). According to the Building Act, the site decision on the siting is issued by a local department of planning and building management; the construction permit and operating permit (but also the permit or order to remove the structure) are then issued by the special authority of planning and building management, which is the Ministry of Industry and Trade of the Czech Republic. Section 86(2) and

Section 110(2) of the Building Act directly impose liability upon the applicant and operator to present binding opinions or decisions of the authorities concerned according to special regulations, i.e., the Atomic Act.

Provided the related procedure involves interests protected by special regulations, the department of planning and building management shall decide in cooperation with or based on approval from the competent state administrative bodies protecting such interests. A competent state administrative body shall condition its approval upon fulfilment of conditions specified in its resolution issued in agreement with the special act entitling the body to do so. The bodies include in particular:

- technical inspection bodies dealing with conventional safety, including the safety of pressure components and electric systems,
- regional and municipal authorities concerning fire safety, waste management, water consumption and effluents discharge,
- Czech Environmental Inspection – concerning air pollution,
- Local body in charge of public health protection concerning industrial safety in agreement with Act No. 258/2000 Coll., on Public Health Protection.

Act No. 100/2001 Coll., on Environmental Impact Assessment and on Amendment to Certain Related Acts (the Act on Environmental Impact Assessment) impose the obligation to assess installations from the viewpoint of their impact on the environment (the so-called Environmental Impact Assessment"), within a separate procedure preceding the licensing procedure. This procedure involves the affected municipalities, authorities and the public represented by individuals as well as societies. The Ministry of the Environment is the competent authority responsible for the issuance of a binding opinion concerning the environmental impact of the nuclear power plant).

7.2.3 Inspection and assessment

The SÚJB performs inspections of compliance with the requirements of the Atomic Act, regulations issued for its implementation and fulfilment of the decisions issued on the basis thereof, as well as the commitments arising from international treaties by which the Czech Republic is bound, if they relate to the peaceful use of nuclear energy and ionising radiation, and fulfilment of the obligations set out by the Act on Metrology in the case of meters intended or used for measurement of ionising radiation and radioactive substances. The inspection activities of the SÚJB are regulated in detail by Section 200 and the following paragraphs of the Atomic Act and Act No. 255/2012 Coll., on Inspection (Inspection Code), which sets out the general rules for inspection authorities in the implementation of inspection activities. The two acts above provide the SÚJB with corresponding power and competency for execution of the state supervision. For a detailed description of the above mentioned requirements and approval procedures see Chapters 14, 15, 16, 17, 18, and 19 hereof.

Inspectors are SÚJB inspectors, appointed by the SÚJB Chairperson. They work at the SÚJB Headquarters and directly at the sites of both nuclear power plants (EDU and ETE), as well as in the Regional Centres (see Chapter 8).

Following with the Inspection Code, the inspectors are also entitled:

- to access to buildings, means of transport, to the land and other areas except for a dwelling owned or used by the inspected person and/or otherwise directly connected with the performance and purpose of the inspection activities, if necessary for the performance of inspection activities; inspectors are authorised to access to a dwelling only if such a dwelling is used to run a business or pursue another economic activity or in the case when any doubts as to the use of a dwelling for such purposes should be removed through the inspection and the purpose of the inspection cannot be achieved otherwise;

- to require proof of identity from a natural person who is present in the place of inspection if he/she is the person performing the tasks assigned to the inspected person, or if he/she is the person who may contribute to achieving the purpose of the inspection;
- to take samples, perform the necessary measurements, monitoring, inspections and tests;
- to require the provision of data, documents and things relating to the purpose of the inspection or the activities of the inspected person; in justified cases, the inspectors may seize original supporting documents;
- to make video or audio records;
- to require the inspected person and liable person to provide further cooperation needed for the performance of inspection activities.

The SÚJB is authorized to perform unscheduled inspections at any time, usually, they are performed at least in the following cases:

- Events preliminarily classified as INES 2 and higher.
- Events preliminarily classified as INES 1, if they prove serious upon their primary analysis by the SÚJB specialists.
- Events with unclear findings of the investigation by the licensee, in particular in the field of breach of the Limits and Conditions.
- Events, which prove safety-relevant based on their evaluation using the PSA.
- Events whose root causes are linked to more serious system failure at the level of top management of the inspected person.
- Unannounced/*ad hoc* inspections of the IAEA.

For the evaluation of inspection activities, an Assessment Commission is established for inspections, which consists of the SÚJB executives and specialists and is headed by the Director of the Nuclear Safety Section.

The Assessment Commission shall, among others:

- discuss and analyse all inspections held in the previous period based on the reports and assessment sheets,
- verify the correctness of the classification of the findings into functional areas and confirm or modify the assessment categories proposed by the head of the inspection team,
- based on the evaluation of inspection activities for the past period, update the Plan of Inspection Activities of the SÚJB in a nuclear installation in the form of requirements for *ad hoc* inspections,
- decide on inspector proposals to initiate administrative procedures to impose a remedial measure (Section 204 of the Atomic Act),
- deal with suggestions from the continued evaluation of inspection activities,
- keep a database of inspection registration,
- prepare documents for the semi-annual and annual assessment of inspection activities of the SÚJB,
- conduct an assessment regularly, in principle once a month,
- assess the social impact caused by illegal conduct in terms of possible offences and propose the initiation of an offence procedure.

7.2.4 Enforcement of applicable regulations and terms for licences

The SÚJB may cancel the previously issued licence (pursuant to Section 22(6) of the Atomic Act), such as a licence for the operation of a nuclear installation if:

a) the licence holder seriously fails in his or her obligations under this Act or fails to remedy serious deficiencies in the activities found by the SÚJB,
b) the licence holder no longer satisfies the conditions relevant for the issue of the licence, or
c) the licence holder applies in writing for licence cancellation and provides evidence that nuclear safety, radiation protection, technical safety, safe management of nuclear materials, and radiation extraordinary event management have been ensured.

If the SÚJB finds a deficiency in the activities of persons performing activities related to the use of nuclear energy or activities in exposure situations, it may impose, by decision, depending on the nature of the deficiency found, corrective measures on the persons and set a time limit for the implementation of the measures to correct the deficiency found (Section 204 of the Atomic Act).

The inspectors are authorized to impose binding instructions, which may consist of a ban on the actions exhaustively listed by law, if not carried out following the requirements of this Act and if there is danger in delay. The inspectors are authorized to order the seizure of radioactive waste, nuclear material or any other ionising radiation source if unauthorized management of radioactive waste, nuclear material or other ionising radiation source is demonstrated (Section 203 of the Atomic Act).

The Atomic Act also provides for a list of actions that are considered delinquent, and the penalties for such offences. Choosing the facts attempts to reflect all the obligations imposed by law, which are relevant for the fulfilment (protection) of the public interest, and which could be violated to the extent requiring compulsion from the state.

Statement on the implementation of the obligations concerning Article 7 of the Convention

A system of the described legal documents – acts, decrees, governmental orders, international treaties and intergovernmental agreements by its nature and contents meets the requirements established in paragraphs 1 and 2 of Article 7 of the Convention.

8. REGULATORY BODIES

(i) Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

(ii) Each Contracting Party shall take appropriate steps to ensure effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.

8.1 Establishment of the regulatory body

8.1.1 Legal framework and statute of the regulatory body

The SÚJB was established through the Act of the Czech National Council No. 21/1993 Coll., as a central authority of the state administration of the Czech Republic. In agreement therewith after the dissolution of the Czech and Slovak Federal Republic, the SÚJB assumed power and competency of the former Czechoslovak Commission for Atomic Energy (ČSKAE) concerning the state administration and supervision of nuclear safety and nuclear materials. In July 1995 the Czech Republic’s Parliament extended the SÚJB competence to include issues of protection against ionising radiation. Following this step, the regulatory bodies in the field of nuclear safety and radiation protection merged in the Czech Republic. The SÚJB thus became a central state administrative body in the field of utilisation of nuclear energy and ionising radiation.

The competence of the SÚJB has been further extended by amendment to Act No. 19/1997 Coll. to include state administration and inspecting of the ban on chemical weapons and by Act No. 281/2002 Coll., concerning the ban on bacteriological (biological) and toxin weapons.

From 1 January 2017, the scope of activities of the SÚJB is defined by Act No. 263/2016 Coll., Atomic Act, which incorporates all the requirements of the relevant rules of the EU and Euratom in the area of inspection activities, supervision of technical safety of selected equipment and dealing with offences.

8.1.2 Mandate, mission, and tasks

The State Office for Nuclear Safety is a central state administrative body in the field of utilisation of nuclear energy and ionising radiation. The head of the SÚJB is a Chairperson, who is designated and may be recalled by the government; the selection, designation and recalling of the chairperson are regulated by the Act on State Services.

The SÚJB is as the central body of state administration pursuant to Act No. 1/1993 Coll., the Constitution of the Czech Republic, and pursuant to Section 236 of the Atomic Act, fully competent to adopt decrees implementing provisions of the Act. The SÚJB is the guarantor of the safe utilisation of nuclear energy and ionising radiation in the Czech Republic. The SÚJB Chairperson decides on the appeal against the SÚJB's decision.

Following the provisions of the Atomic Act, the SÚJB shall:

a) issue licences for the performance of activities and register and receive notifications of activities;
b) type-approve packaging assemblies for the carriage, storage, or disposal of radioactive or fissile materials, sources of ionising radiation and other products,

c) grant authorisations for the performance of activities of relevance to nuclear safety and radiation protection,
d) approve documentation for licensed activities,
e) establish the emergency planning zone,
f) monitor and assess the exposure situation and regulate exposure of natural persons, including exposure to natural sources of radiation and draw up, in cooperation with the relevant administrative authorities, national plans to address and provide information about situations,
g) issue, register and verify individual radiological monitoring documents,
h) maintain lists and registers in the area of the peaceful utilisation of nuclear energy and ionising radiation, including lists and registers according to international treaties binding on the Czech Republic,
i) establish the design basis threat,
j) perform the role of the organisation for international verification of compliance with the comprehensive nuclear test ban,
k) ensure international cooperation within the field of its competence, provide information from the field of its competence to the International Atomic Energy Agency, the European Commission and other authorities of the EU and the Euratom and ensure implementation of other obligations arising from EU and Euratom legislation relating to, in particular, the national and international evaluation of the exercise of State Authority over nuclear safety of nuclear installations and management of nuclear materials and high-activity sources,
l) decide on the management of nuclear items, sources of ionising radiation or radioactive waste in cases where they are managed in conflict with legislation or a situation that has arisen is not being rectified, including cases when these have been found, and, if necessary, organise a search for such sources of ionising radiation,
m) once a year, present to the Government and to the public a report on its activities and an annual report on radiation situation monitoring in the territory of the Czech Republic,
n) submit opinions on territorial development policies and territorial planning documentation in terms of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security of activities related to the use of nuclear energy and activities in exposure situations,
o) provision of information in the area of radioactive waste and spent nuclear fuel management;
p) issue binding opinions on spatial planning decisions concerning construction on land where a closed radioactive waste disposal facility is sited; the binding opinions of the Office shall express if the intended plan is acceptable from a perspective of radiation protection or monitoring of radiation situation and set down conditions of ensuring radiation protection or monitoring of radiation situation relevant to this plan,
q) issue binding opinions in proceedings and other actions relating to a nuclear installation under the Building Act,
r) provide information on important findings obtained in the context of its inspection activities and from reporting on radiation extraordinary events and radiological occurrences, including information relating to the justification of activities, regulation of sources of ionising radiation and radiation protection,
s) draw up and update the national action plan for regulation of public exposure to radon and define the concept for the management of existing exposure situations,
t) inform the general public about potential risks of exposure from a source of water for an individual supply providing on average less than 10 m^3 a day, or serving fewer than 50 persons, unless the water is supplied as part of a commercial activity or public service.

Following Section 200, the SÚJB performs inspections of compliance with the Atomic Act, regulations issued to implement this Act, commitments arising from international treaties binding on the Czech Republic applicable to the peaceful use of nuclear energy and ionising radiation, and decisions issued based on this Act, and performance of the obligations laid down in the Metrology Act as regards ionising radiation measuring gauge.

The SÚJB shall inspect licence holders, registered persons and notifying persons; manufacturers, importers and distributors of type-approved products; persons performing activities in the context of the peaceful use of nuclear energy and ionising radiation not subject to authorisation; persons engaged in radiation situation monitoring; holders of authorisations for the performance of activities of particular relevance to nuclear safety and radiation protection; authorised and accredited persons assessing the conformity of selected equipment with technical requirements, and other persons in respect of whom there are reasonable grounds for believing that they are breaching obligations laid down in the Atomic Act.

The following SÚJB priorities are set for 2022:

- Administrative procedure to obtain a licence for further operation of Temelín NPP Unit 2 and licensing of the VR-2 research reactor.
- Issues of radiation accident and radiation emergency management regarding to the use of the experience gained during the COVID-19 pandemic.
- Implementation of the National Radiation Emergency Plan into the relevant documentation and putting its requirements into practice.
- Presidency of the Joint 8th and 9th Review Conferences on the Convention on Nuclear Safety.
- Czech Presidency of the Council of the EU with an emphasis on the AQG agenda.

8.1.3 Authorities and responsibilities

Within the scope of its responsibility under the Atomic Act, the SÚJB shall:

a) draw up the national monitoring program and, after it has been approved, forward it to the Ministry of Defence, the Ministry of Agriculture, the Ministry of the Environment, the Fire Rescue Service of the Czech Republic, the Police of the Czech Republic, customs authorities of the Czech Republic, the Agricultural and Food Inspection Authority, and persons who are holders of a tip, settling pond or other residue of the activity related to acquiring of radioactive minerals or other mining activity accompanied by the occurrence of a radioactive mineral, or other persons for selected parts of the territory of the Czech Republic,

b) manage and carry out radiation situation monitoring in the territory of the Czech Republic, including the comparative measurements organised by the European Commission, evaluate its results and report radiation situation monitoring data to the European Commission,

c) ensure and conduct drills and emergency exercises for radiation extraordinary event response,

d) in cooperation with the Ministry of the Interior, draw up the national radiation emergency plan for threat categories depending on the magnitude of the potential impacts of a radiation incident or radiation accident in the territory of the Czech Republic,

e) provide preliminary information to the general public for the event of a radiation accident, concerning protective measures and steps that need to be taken to ensure radiation protection; the preliminary information provided shall be up-to-date and constantly available and it shall be provided automatically and repeatedly, at regular intervals and whenever a significant change occurs,

f) issue proposals for urgent protective actions or follow-up protective actions, in accordance with the national radiation emergency plan and on the basis of the results of the radiation situation monitoring carried out, or to further specify or withdraw the action and to confirm or further specify proposals for the introduction of urgent protective action issued by licence holders,

g) ensure information of the general public about the occurrence and the course of a radiation accident which has an impact on the territory of the Czech Republic outside an emergency planning zone and about the steps and measures to be taken during the various stages of development of the radiation accident, unless this information is being provided by another administrative Authority,

h) participate, within the scope of its competence, in the provision of information about the occurrence and the course of a radiation accident within an emergency planning zone,

i) ensure that the competent regulatory authorities of neighbouring Member States of the Euratom are notified of the occurrence and the course of a radiation accident which has an impact on the territory of the Czech Republic and about the steps and measures to be taken during the various stages of development of the radiation extraordinary event,

j) ensure that an international peer review is invited immediately in the case of a radiation accident that has occurred in the territory of the Czech Republic and led to the implementation of protective measures outside a nuclear installation grounds,

k) provide information about the adoption of measures to protect the general public in the Czech Republic in the event of a radiation accident arisen in the territory of Member States of the Euratom to the European Commission and other Member States of the Euratom which may be affected by these measures and, in accordance with the Czech Republic’s international commitments, provide public access to information thus obtained,

l) ensure notification of regional authorities about the occurrence and the course of a radiation accident outside the territory of the Czech Republic and about the steps and measures to be taken in the course of the radiation extraordinary event.

The powers of the SÚJB are the issuing of the decision on a licence for specified activities, approval of the documentation for a licensed activity, type approval of certain products, receipt of notifications, registration of activities, keeping the records, performance of inspection activities of compliance with the principles of peaceful utilization of nuclear energy and ionising radiation, and the creation of legislative regulations governing the conditions for the peaceful use of nuclear energy, the operating conditions in the context of exposure situations, the management of radioactive waste and spent nuclear fuel, radiation situation monitoring, radiation extraordinary event management, conditions for the security of a nuclear installation, nuclear material and ionising radiation source, requirements to ensure nuclear non-proliferation and the type approval of certain products. The SÚJB deals with offences under the Atomic Act, issues a decision imposing a fine and collects fines provided for by law.

In the matter of issuing a decision on the licence, Section 9 of the Atomic Act lays down requirements, which are referred to in Chapter 7.2.2 hereof. No adjustment to the equipment or other technical or organizational changes affecting nuclear safety, technical safety and physical protection of a nuclear installation or reconstruction or other changes affecting radiation protection, radiation situation monitoring, and radiation extraordinary event management may be made without the prior consent of the SÚJB. Changes that affect the off-site emergency plan shall be made only based on an agreement with the respective Regional Office and affected municipal offices of municipalities with extended competencies.

The SÚJB may change the decision on a licence if there is a substantial change in the facts under which the original licence was issued, or if there is a change in the performance of an originally licensed activity that is significant in terms of nuclear safety, radiation protection, technical safety, nuclear non-proliferation, radiation situation monitoring, radiation extraordinary event management, and security. Conditions of the licence that affect off-site emergency plan may be specified and changed only based on an agreement with the respective Regional Office and affected municipal offices of municipalities with extended competencies.

The SÚJB issues a decision on the approval of documentation listed in Annexes to the Atomic Act for the following documents:

- limits and conditions,
- limits and conditions for radioactive waste management,
- program of inspections for the construction stage,
- in-service inspection program,
- list of selected equipment,
- preliminary physical protection assurance plan,
- physical protection assurance plan,
- monitoring program,
- on-site emergency plan,
- emergency rules for the transport of radioactive materials,
- emergency planning zone,
- decommissioning plan,
- order on the inspection and registration of nuclear materials.

Pursuant to Section 137 of the Atomic Act, the SÚJB issues a decision on type approval of packaging assemblies for transport, storage or disposal of a radioactive or fissile material as well as a decision on type approval of special form radioactive material and low dispersible radioactive material.

Based on successful examinations before the examination commission, which is established by the SÚJB, an authorization is issued to selected workers to perform activities specifically important to nuclear safety and radiation protection.

The SÚJB also performs management of fees for the SÚJB's expert activities that shall be paid by an applicant for a licence for siting, construction, first licence for operation and particular stages of decommissioning of a nuclear installation (application fee) and a holder of the licence for the operation or decommissioning of a nuclear installation (maintenance fee). Health facilities that perform the activities under the Atomic Act in exchange for reimbursement from the public health insurance system, public universities and those, whose activity is financed from public funds for science and research including EU funds, are exempted from these fees. Fees for the professional activity of the SÚJB are the income for the state budget, Chapter "SÚJB".

If the licence holder has seriously violated the obligations stipulated by the Atomic Act or failed to remove serious deficiencies in the activity identified by the SÚJB, or the licence holder no longer meets the vesting conditions of the licence, the SÚJB may withdraw the decision. The SÚJB shall also cancel the licence if its holder ceases to fulfil the conditions decisive for its granting or if the holder does not fulfil his duties stipulated by the Atomic Act or if he does not eliminate the shortcomings detected by the SÚJB. The SÚJB may also require the implementation of a specific safety assessment in the case of a suspected reduced level of nuclear safety resulting from its administrative and inspection activities.

The general rules governing the procedure of administrative authorities in performing the actions in the matter of issuing decisions are regulated by Act No. 500/2004 Coll., the Administrative Code.

The SÚJB is entitled to define measures in the form of general measure to control exposure in existing exposure situation that is the result of an accident exposure situation or discontinued operations in the context of planned exposure situation if there could be a significant increase in health damage as a result of exposure of a member of the public without changing the state. The SÚJB shall start, in the context of management of radiation situation monitoring in case of emergency exposure situation, emergency monitoring and depending on its scope and following the monitoring program, the SÚJB may determine the extent and manner of participation of individuals in emergency monitoring.

The SÚJB supervises the lasting exposure by setting out the reference levels for the average effective dose to the representative person per calendar year in the range from 1 to 20 mSv. The SÚJB issues proposals for the introduction, clarification or withdrawal of protective measures relating to contaminated areas and members of the public to remedy the situation after radiation accident for the area affected by radiation accident or any part thereof after the termination of the response to a radiation extraordinary event in the management of the contaminated area.

8.1.4 Organizational structure

The organizational structure of the SÚJB is shown in Fig. 8-1 and consists of:

- Section for Nuclear Safety including Nuclear Safety Assessment Department with Divisions of Components and QA Assessment, Electrical and I&C Assessment, Reactor Physics and Safety Analysis and Coordination of Assessment; Nuclear Installation Inspection Department with Divisions of Inspection of Systems, Inspection of Operation and Feedback and Site Inspectors at both nuclear power plant sites (Dukovany NPP and Temelín NPP) and an autonomous Spent Fuel and Radwaste Management Division.
- Section for Radiation Protection including Exposure Regulation Department with Divisions of Natural Radiation Sources, Radon Program, Registers and Exposure Assessment and the Regional Centre in Hradec Králové; Radiation Sources Department including the Regional Centres in Ostrava, Plzeň, Prague, and Ústí nad Labem; Radiation Protection of Fuel Cycle Department with the Regional Centres in Brno, České Budějovice, and Kamenná. As of 1 March 2020, it includes the Monitoring and Crisis Management Division, which was previously directly subordinate to the SÚJB Chairperson within the Crisis Management and ICT Department (based on the government-approved change in systematisation, see Government Resolution No. 142 of 24 February 2020).
- Section for Management and Technical Support with Non-Proliferation Department with Nuclear Non-Proliferation and Chemical and Biological Weapons Prohibition Divisions; Economic Department with Budget and Accounting Divisions; Office Bureau with Organizational Affairs of Service and Public Procurement Divisions; International Cooperation, Strategy, Legal, and IT and Record Management System Divisions.
- Internal Auditor.
- Director for Security.

8.1.5 Human resources

For 2022, the SÚJB has established 218 posts attributed (in 2019 it was 210), of which 190 are service posts (in 2019 it was 182) pursuant to Act No. 234/2014 Coll., on Civil Service, as amended.

Of the total number of employees, the highest number of employees has university degrees. Among other authorities of the state administration, the SÚJB is at the forefront in the indicator for the ratio of the number of university graduate employees to the total number of employees. The SÚJB's staffing is stabilized in compliance with the requirement laid down in the Act on Civil Service. The number of job positions is approved by the Government of the Czech Republic, and it may be changed only with its consent. The SÚJB Chairperson, based on this systematization, approves the organizational structure of the SÚJB.

The state administration in the field of nuclear safety and radiation protection is performed by nuclear safety and radiation protection inspectors, who fulfil the requirements laid down in the Act on Civil Service set out following the competencies of the SÚJB under the Atomic Act. The inspectors are appointed by the SÚJB Chairperson. About two-thirds of the number of all employees of the SÚJB are the inspectors. Part of the inspectors works directly in the place of nuclear power plants or in regions.

The qualification requirements and specialization for the job positions of inspectors are set out in the internal management document (service regulation). Inspectors shall have a university degree of masters type with technical or natural-scientific specialization. The required level of language skills (usually English) is also determined for all categories of inspectors. Some inspectors are experts from industry, research, or nuclear installations. The SÚJB also employs university graduates, who fulfil the criteria as to the relevant expertise.

Ensuring competent human resources remains a long-term and important issue. The Civil Service Act does not create completely ideal conditions for recruiting specialists from the external environment, or for the stabilization of juniors after their training. The situation is even worse given the Czech Republic has one of the lowest unemployment rates on a long-term basis, between 3 and 3.5 %.

For example, the Section for Nuclear Safety is currently unable to fill around 10 % of the attributed posts of inspectors in the long term, and 5 % of other posts are now temporarily vacant due to parental leave. This shortfall is partially compensated for by strengthening the external support in the TSO (SÚRO).

8.1.6 Measures to develop and maintain competence

Training for the SÚJB staff is organized based on the SÚJB internal regulation VDS 039 SÚJB Staff Training and Evaluation System; the mentioned document is approved by the SÚJB top management and is of an internal regulation nature. The guideline has been developed based on the results of the first part of the project co-financed by the European Social Fund (ESF) Operational Program “Human Resources and Employment – Strengthening Efficiency of Public Administration”, the subject of which was to establish a Systematic Concept of the SÚJB Staff Training and Development.

Systematic performance and individual approach to individual employees are the fundamental principles in training for the SÚJB staff. The objective is to preserve the continuous character of training by combining general and specialized training. The SÚJB also makes use of the SÚJB’s internal lecturers from among experienced specialists.

Every staff member has a specific Personal Development Plan (IPOR), where the most important component is all retraining and/or training for new tasks. The performance of the Personal Development Plan is reviewed annually and (if necessary) updated based on an interview between the employee and his/her immediate superior. For managers at various levels, one of the sources for the creation/revision of the Personal Development Plan is the results of competence mapping, which is regularly performed by each of the main units of the SÚJB.

As part of the training provided for inspectors, the special course focused on nuclear technologies was organized in the Training Centre of the ČEZ, a. s., in Brno on repeated occasions. Other SÚJB inspectors, in particular site inspectors from nuclear power plants, completed training on the full-scale simulator of the control system of the nuclear power plant under the supervision and improved thus significantly their qualification for their inspection activities. The inspectors participate also in the SÚJB internal seminars organized for every significant event or event of interest from the viewpoint of the SÚJB sphere of action. The seminars are especially focused on event description and cause analysis. Specialists working in the TSO (SÚRO) are also used for highly professional training. The training system itself is set up and provided appropriately, limiting, as described in the previous subchapter, the failure to fill vacant posts with appropriate staff members.

The SÚJB uses the learning actions organized by various training entities such as the Public Civil Servants Training Institute to train SÚJB inspectors in other fields related to the performance of their function such as interpretation of the provisions of related legislation, language training, communication skills and use of software applications.

8.1.7 Development concerning the financial resources

The SÚJB has its own budget approved by the Chamber of Deputies of the Parliament of the Czech Republic as a part of the state budget. The approved budget of the SÚJB costs for 2019 amounted to approximately CZK 429.8 million (approximately EUR 16.6 million) and for 2022 it amounts to approximately CZK 459 million (approximately EUR 18.7 million).

Based on the approved systematization of the SÚJB, the wage and salary conditions are set out for systematized posts. The amount of wages and salaries is regulated by Government Decree No. 341/2017 Coll., on emoluments of state service and administration employees, and Government Decree No. 304/2014 Coll., on emoluments of state employees, when the SÚJB is classified in the category of public employees with the highest demands as to the expertise.

The sources of funding for the State Budget of the Czech Republic intended for Chapter “SÚJB” include fees for professional activity of the SÚJB. The final amount is determined by the regulation of the Czech Government. In the case of the submission of applications for a licence for siting, construction, operation, and particular stages of decommissioning of a nuclear installation, the amounts are between CZK 30 and 50 million. In 2021, for example, the application for a licence for siting two nuclear units in the Dukovany site submitted by the ČEZ, a. s., or its subsidiary Elektrárna Dukovany II, a. s., amounted to CZK 39.2 million (approximately EUR 1.6 million), see Chapter 17.1.5). The rate of maintenance fee, which shall be paid by the holder of a licence for the operation or decommissioning of a nuclear installation, amounts to CZK 4 million (approximately EUR 0.16 million) per calendar month. In 2021, the maintenance fees were CZK 234 million (approximately EUR 9.5 million).

8.1.8 Statement of the adequacy of resources

In the current conditions of the Czech Republic, material and human resources are sufficient for fulfilment of the functions imposed by the Atomic Act. (See previous chapters above.)

8.1.9 Management system of the regulatory body

The priorities of the SÚJB are set out to fulfil, to the extent possible, its mission, which is the respected, professional, and independent performance of the state administration including supervision of the utilization of nuclear energy and ionising radiation and in the non-proliferation of weapons of mass destruction. The priorities are also based on the long-term strategies set by the state and the documents related to them (State Energy Policy, National Action Plan for the Development of the Nuclear Energy Sector).

The integrated management system of the SÚJB creates a single and controlled environment for its activities and sets the control rules of management binding upon all of its employees. The management system of the SÚJB, as the central state administrative body, is built upon the principles and requirements laid down by the legislation of the Czech Republic and by European legislation, international conventions, and agreements in the field of the SÚJB competence. Standards and Recommendations of IAEA, WENRA, Organisation for Economic Co-operation and Development – Nuclear Energy Agency (OECD-NEA), International Commission on Radiological Protection (ICRP) and other international institutions.

The documentation for the integrated management system is produced in a manner from general to more specific considering the diversity of the processes ensured in different sections of the SÚJB and in a graded approach in the context of the significance of processes. A unified approach is implemented to develop internal organizational regulations of the SÚJB and a mandatory procedure for the process of creating, revising, and signing them is defined. The process of creating and revising the organizational regulations includes their specification, elaboration, commenting, approval, issuing, distribution and archiving.

The internal organizational regulations of the SÚJB are divided by binding force into three levels:

A. for the entire SÚJB or several sections thereof,
B. for one section or several departments within one section,
C. for one department or autonomous unit,

and then by specialization in substance:

- Policy – description of the principles, which serve as a basis for management of the selected area,
- Direction – description of the process as a set of interrelated or interlinked activities of a repetitive nature,
- Methodological instruction – methodological description of certain activities performance not dealing with the process as a whole, but only its parts.

The internal organizational regulations of the SÚJB have identically defined chapters in the table of contents. The internal organizational regulation is reviewed whenever there is a change in inputs or requirements for the area addressed by the internal organizational regulation or after the expiry of the time limit set for the review.

Level A policies are the Integrated Management System Policy and Manual of Integrated Management System of the SÚJB.

The A-level basic orders are: Organizational Order, Working Order, Archiving and Discarding Order; Review and Evaluation of Internal Activities; Planning, Performance and Evaluation of Inspection Activities at Nuclear Installations; Rules for Radiation Protection Inspections at Nuclear Power Plants; Procedure for Issuing Licence for Nuclear Installation Commissioning; SÚJB Staff Training, Education and Evaluation System; Order Establishing the Examination Commissions for Verification of Special Professional Competence and Statutes for these Commissions; Order for Budgetary Management in the SÚJB (Internal Budgetary Order); Principles of Internal Audit.

The A-level organizational standards include: orders issued by the SÚJB Chairperson, which regulate specific activities, e.g. staffing and activity of the crisis staff, the establishment of the teams responsible for the evaluation of extensive and technically difficult documents (Safety Analysis Reports, documentation for approval of the operation of a nuclear power plant beyond its design lifetime), securing and administration of the website, drafting of the reports on the SÚJB activities (annual, national), administrative activities resulting from the requirements laid down by the Service Act, organization of the preparation and elaboration of the National Monitoring Program or appointment of commissions. The B and C level standards are then issued by the other SÚJB executive staff to cover the activities in the competence of the SÚJB's divisions managed by them.

The important methodological instructions related to the activities carried out by the SÚJB inspectors include the inspection procedures for the inspection of the state of all safety-relevant structures, systems and components of nuclear power plants, changes and modifications to projects of nuclear installations, the readiness of a nuclear installation for operation, radiation situation monitoring, operation of fresh and spent nuclear fuel storage facilities, transportation of nuclear materials, and inspections of other licensees' activities regulated by law. The methodologies are also prepared for the needs of assessment of licensees' safety-related documentation, using the PSA, assessment of the level of licensee's safety culture or assessment of the safety performance indicators.

Part of the SÚJB's internal regulations is also marked as an operating procedure according to the Act on Civil Service, by which all the state institutions are bound. This particularly concerns internal regulations relating to service-legal relationships, code of ethics or fight against corruption.

The management system is fully integrated into the activities of the SÚJB. The continuous development process is based on the activities of the Quality Team, which has become a functional platform for open discussion on the current situation in the Office, providing feedback, obtaining new impulses, ideas and suggestions, and for optimizing and improving the management system of the SÚJB since its establishment in 2019.

In 2021, the set of rules for project management was completed, while the experience gained mainly from the pilot project for siting Dukovany NPP Units 5 and 6 was used. The SÚJB has finalized and implemented a change management system. This created an environment for the submission of internal suggestions leading to a demonstrable improvement in the activities of the SÚJB.

The SÚJB has developed the Strategy of the State Office for Nuclear Safety containing objectives aimed at further improving the internal operation of the Office. It is developed for a period of 3 years, currently for the years 2021 to 2023. The strategic objectives are evaluated on an annual basis and their fulfilment is reflected in the setting of priorities of the activities of the SÚJB for the next period.

In connection with the “Strategy”, a new Concept of Research, Development, and Innovation was drawn up for the needs of the State Office for Nuclear Safety for the years 2021 to 2025, aware of the need to provide scientific and technical support for the independent performance of state supervision. The basic objective of the “Concept” is to define the desired research directions in basic strategic areas to ensure the acquisition of new knowledge, data, and tools for strategic and methodological, inspection and administrative activities, improvement of decision-making systems, and state administration provided by the SÚJB.

The process of improvement never ends, further development and implementation of the management system will continue. The main challenges for the next period are developing the concept of the safety culture of the regulator, updating the system of reviewing and evaluating own activities or adjusting the employee satisfaction survey system in the context of deepening work with human capital.

8.1.10 Openness and transparency of communication with the public

The SÚJB website was created to facilitate gathering information concerning the performance of state administration, including supervision, in the field of utilization of nuclear energy and ionising radiation, and non-proliferation of nuclear weapons. The website was created with respect to the accessibility and free access following Act No. 99/2019 Coll., On Accessibility of Websites and Mobile Applications.

Following the information policy of the state administration, the most relevant information is subject to mandatory disclosure on the so-called “official notice board”, which is transformed into the Electronic Notice Board on the website. The existing legislation (Acts and Decrees) is made available on the website. Annual reports, national reports, important decisions, and safety guides and recommendations are published in the “Reports” section. Important information includes the Instructions to the population upon the occurrence of an extraordinary event, e.g., when finding or upon the occurrence of substances of unknown origin, general principles concerning behaviour in threat or during an accident at a nuclear installation or any other accident involving release of radioactive substances. The SÚJB makes available the inspection plan to the general public in a manner allowing remote access.

Other parts of the website contain information from the field of nuclear safety, radiation protection, radiation situation monitoring, seismicity monitoring, emergency preparedness, and non-proliferation of weapons of mass destruction. Information on international cooperation, EU, WENRA, and the results of the Stress Tests of nuclear power plants is also included. The inspection plans have been published since 2015, in common for three main activities. The most important contact information to the management is also provided. The English version of the website is also available.

The SÚJB keeps public records of nuclear installations and ionising radiation sources, medical exposure data, personal radiation passports, approved types of containers for transport and storage of fissile or radioactive substances, ionising radiation sources and other products. The SÚJB also keeps registers of licence holders, registered persons, notification bodies, and holders of a licence to perform activities specifically important to nuclear safety and radiation protection. The SÚJB shall issue on request a full or partial extract from the public records to any person who shows a legal interest. The SÚRAO publishes a register of radioactive waste producers.

The SÚJB publishes information in a manner allowing remote access including:

a) licences issued,
b) authorisations granted for the performance of activities of particular relevance to nuclear safety and radiation protection,
c) registrations made,
d) notifications received,
e) data from the radiation situation monitoring in the territory of the Czech Republic.

The SÚJB, just as the other central state administrative bodies, provides the public with information pursuant to Act No. 106/1999 Coll., on Free Access to Information, and Act No. 123/1998 Coll., on the Right to Environmental Information.

Pursuant to Section 18 of Act No. 106/1999 Coll., the annual report on providing information, which the Office is obliged to publish in accordance with the aforementioned Act, was included in the Annual Report on the SÚJB Results Achieved in the Supervision of Nuclear installations and Radiation Protection. The Act designates information that cannot be disclosed, e.g., personal information, classified information or information that is a trade secret in nature. Therefore, the website includes the section “Styk s veřejností” (Public Communication). This page gives instructions for obtaining information, answers to questions asked through a web-based application and the frequently asked questions (FAQ). The SÚJB provides not only information on the current state of performance of the nuclear power plants in the Czech Republic but also on the events that occurred at NPPs. The SÚJB has also its Facebook page to publish brief information and curiosities, for example, from the field of the nuclear industry, ionising radiation utilization, nuclear safety, and radiation protection for the general public.

8.1.11 External support to regulatory activities

The SÚJB uses other organizations to carry out its activities. These include the National Institute for Nuclear, Chemical and Biological Protection (SÚJCHBO) and the National Radiation Protection Institute (SÚRO). Those public research institutes were formed by transforming from the original organizational bodies of the state. SÚJCHBO provides primarily professional and technical support to the SÚJB in the field of chemical and radiation safety. SÚRO provides professional and technical support in the field of radiation protection and nuclear safety.

In 2019, the planned volume of financial contributions to these two institutes from the SÚJB budget amounts approximately to CZK 134 million (EUR 5.2 million). Compared to 2016, this was an increase of 64 % due to the establishment of a new Nuclear Safety Section in the SÚRO in 2018. In 2022, it amounts to approximately CZK 144 million (EUR 5.9 million), of which CZK 28.7 million (EUR 1.2 million) for SÚJCHBO and CZK 115.6 million (EUR 4.7 million) for SÚRO.

In 2021, the SÚJB scientific and technical support for nuclear safety was provided by SÚRO in the Deputy for Nuclear Safety Section. As of 31 December 2021, the section consisted of 32 full-time employees, approximately 24 full-time equivalents.

In 2021, the section was reorganized into two departments and one separate unit:

- Nuclear Safety Research and Assessment Department,
- Support of State Supervision of Nuclear Safety Department,
- SÚJB Supervision Support Unit in the field of radioactive waste.

The Nuclear Safety Research and Assessment Department:

- performs research activities in the field of nuclear safety and develops the knowledge base in various fields of nuclear safety in accordance with the state of the art,
- ensures the operational availability and timeliness of computer codes and calculation models of nuclear installations for nuclear safety analyses,
- provides analytical and computation support to the SÚJB in the field of neutronics of reactor cores, system thermohydraulics, thermomechanical behaviour and subchannel analyses of nuclear fuel, including analyses of severe accidents for independent nuclear safety assessment,
- at the request of the SÚJB, assesses the safety documentation and prepares expert opinions within the licensing procedures of the SÚJB.

Support of State Supervision of Nuclear Safety Department:

- provides support for the performance of state supervision in ensuring nuclear and technical safety in the field of management systems and its changes, siting, design, construction and operation of a nuclear installation, quality assurance, conformity assessment and verification of selected equipment, periodic, ongoing and special safety assessment,
- ensures the performance of activities of the invited person during the inspection activities of the SÚJB,
- provides expert support to the SÚJB in meetings with licence holders in the Czech Republic,
- provides expert support to the SÚJB in international meetings,
- cooperates in the creation of legislation and safety instructions in the area of its competence,
- at the request of the SÚJB, assesses the safety documentation and prepares expert opinions within the licensing procedures of the SÚJB,
- at the request of the SÚJB, assesses international normative documentation and prepares expert comments on this documentation.

Separate the SÚJB Support Unit in the field of radioactive waste:

- performs research activities in the field of radioactive waste management and develops the knowledge base in this field in accordance with the state of the art,
- provides support for the performance of state supervision in the siting, design, construction, operation, and closure of radioactive waste repositories,
- at the request of the SÚJB, assesses the safety documentation and prepares expert opinions within the licensing procedures of the SÚJB.

The SÚJB also cooperates with many other organizations such as research institutes (e.g., Centrum výzkumu Řež), departmental organisations of the ministries (e.g., Ministry of the Environment – Czech Geological Survey), technical and science universities, Academy of Sciences of the Czech Republic, relevant national and international organizations, companies and private experts in the field in question (in the field of the natural characteristics of the sites, external hazards, civil engineering industry, and assessment of events and human factor). The supporting entities are obliged to be separate from and independent of an operator of a nuclear installation. Expert support is particularly used in the assessment of Safety Analysis Reports and documentation attached to the application for a licence. In addition, the SÚJB uses expert entities in narrowly specialised inspection activities linked to sampling or measurement.

8.1.12 Advisory committees

The SÚJB executive meeting is the permanent advisory body of the SÚJB Chairperson. In addition to the executive meeting, the Chairperson establishes other permanent or temporary advisory bodies composed of internal and external specialists for specifically serious or complex matters.

The executive meeting is composed of the Director for Nuclear Safety Section, Director for Radiation Protection Section, Director for Management and Technical Support Section, and Director for Crisis Management and Informatics. The executive meetings are held on dates set out in the work plan of the executive meeting or based on the decision of the Chairperson. Heads of departments, the Director of the National Radiation Protection Institute and the Director of the National Institute for Nuclear, Chemical and Biological Protection shall be invited to the executive meetings as required.

To ensure the selected tasks or specific objectives and defined activities, temporary teams of interdisciplinary members are established by the order issued by the Chairperson or by the order issued by the director of the relevant section.

The Committee of Appeal, which is governed by the approved statute, is the important advisory body of the Chairperson. A meeting of this Committee shall be convened in the event of making decisions on appeal against decisions made by the SÚJB.

8.2 Status of the regulatory body – SÚJB

8.2.1 Place of the SÚJB in the governmental structure of the Czech Republic

The statute of the SÚJB within the administrative structure of the Czech Republic is shown in Fig. 8-2. The SÚJB has its budget approved by the Chamber of Deputies of the Parliament of the Czech Republic as a part of the state budget.

Within its power and competency, the SÚJB is responsible neither to the Ministry of Industry and Trade nor to the Ministry of the Environment, as it is in some similar foreign regulatory bodies. The SÚJB Chairperson is appointed by the Government of the Czech Republic. The Chairperson is accountable for carrying out the state supervision in the field of utilisation of nuclear energy and ionising radiation directly to the Prime Minister, who plays the role of the representative of the SÚJB in the government meetings. Filling of the management positions in the SÚJB respects a selection process pursuant to Act No. 234/2014 Coll., on Civil Service, as amended.

8.2.2 Reporting obligations

In compliance with the requirement laid down in the Atomic Act, the SÚJB submits annual reports on the results of its activities to the Government of the Czech Republic for approval. The annual report summarizes information on the operation of nuclear installations, results of evaluation and inspection activities in all areas under supervision, information on financial matters, legal activities, international cooperation, and public communication. A special part of the "Report" is devoted to the information on the radiation situation in the Czech Republic and the evaluation of the safety performance indicators for nuclear power plants. The "Report" is distributed to the ministries and state bodies for review. Their possible comments and questions are addressed and, as relevant, reflected in the report. The final text of the "Report" is subject to discussion with the Government of the Czech Republic and published on the SÚJB website after its approval[3].

8.2.3 Means by which effective separation is ensured between the functions of the SÚJB and those of any other body or organization

The independence of the SÚJB from other bodies or organizations results from the provisions of Section 207 of the Atomic Act: "The Office is a central administrative Authority for the area of use of nuclear energy and ionising radiation", and also from Section 9 "A licence from the Office shall be required for performing the following activities related to the use of nuclear energy" and Section 19:

[3] www.sujb.cz/dokumenty-a-publikace/vyrocni-zpravy/vyrocni-zpravy-sujb/

“Licences shall be issued based on an application. The applicant shall be the sole party to the procedure.”.

When conducting controls of compliance with the Atomic Act following Section 201 “The persons conducting controls shall be inspectors.” An inspector or an inspection team shall be always appointed from among SÚJB inspectors and the decision to invite other experts to participate in the inspection falls fully under the authority of the SÚJB.

It is obvious from the above-listed legislative documents and the state administration structure in the Czech Republic that the power and competency of the SÚJB are sufficient to perform the state supervision of nuclear safety and radiation protection. At the same time, the scope of powers assigned to the SÚJB does not clash with that of any other state administrative body. The only exception is the approval of the basic design threat that is determined by the SÚJB based on the binding opinion of the Ministries of Interior, Defence, and Trade and Industry.

8.2.4 Review of the SÚJB activities taken by international missions

Chapter 7 hereof describes the changes in the supervisory and legal framework introduced in the second half of the 1990s. After their completion and full implementation in the Czech Republic, the IAEA was requested to independently assess results of the said efforts. The assessment was performed by two International Regulatory Review Team (IRRT) missions, which reviewed the SÚJB in January 2000 and in June 2001.

The first review was a reduced-scope inspection mission focusing mainly on the SÚJB activities relating to the licensing procedure for Temelín NPP. The inspection team concluded its mission by following statements:

- there exists a clearly defined legal framework in place for Temelín NPP licensing and the SÚJB is required to issue a licence for each defined key stage throughout the construction and acceptance period,
- the SÚJB has established requirements as the state regulatory body concerning the level of nuclear safety assurance at Temelín NPP and has adopted a flexible approach to assure that the adopted inspection and assessment criteria are fulfilled,
- the SÚJB has in advance established an inspection plan accordingly fulfilled by its inspectors who check on and confirm that the licensee is commissioning the plant in agreement with the conditions specified in the respective licences,
- experience and assistance of regulatory bodies from West European countries and the USA have been employed to develop an appropriate state regulatory system concerning licensing, supervision, assessment and inspecting of Temelín NPP.

Members of the reviewing team stated several recommendations to the SÚJB whose implementation might further strengthen the performance of the state supervision. All suggestions and recommendations concern the long-term development of the SÚJB and arise from current methodical procedures and the achieved results.

The second mission performed a full-scope review of state supervisory activities in the peaceful utilization of nuclear energy and ionising radiation. Twelve experts from nine countries reviewed of all aspects of state supervisory activities performed by the SÚJB under the Atomic Act, including supervision of nuclear safety, radiation protection, emergency planning, and transport of radioactive materials.

According to the results presented by the experts in a final report from the mission, the experts concluded that both the legal framework and execution of the state supervision of peaceful utilization of nuclear energy and ionising radiation were at a very good standard, corresponding to worldwide accepted practices. For the position of the regulatory body in the state administration structure, the experts highlighted the fact that the SÚJB was independent not only "*de jure*" but also "*de facto*". The experts naturally also worded specific recommendations whose implementation may further increase the standard of supervision in the Czech Republic. The recommendations focused on, for example, emergency preparedness practising and further development in the utilization of probabilistic assessment methods in nuclear safety. It was expressly stated, however, that these recommendations were mostly intended for the long-term development of the SÚJB.

Repeated IRRS mission took place in November 2013

The IRRS mission in 2013 [8-1] again reviewed the regulatory framework of the Czech Republic in the performance of the regulatory body in the area of peaceful utilization of nuclear energy and ionising radiation by comparing to the IAEA standards and generally accepted international criteria. Moreover, the mission was used for information exchange between the SÚJB experts and inspection team members.

The mission focused on responsibilities and functions of the executive power in the field of nuclear safety including regulatory responsibilities and functions, management system and activities of the SÚJB including preparation, content and issuing of safety guides, the legal system – issuing of licences, documentation approval and inspection activity, safety assessment, emergency preparedness including response to a radiological emergency, protection of the population and the environment from ionising radiation, regulation of the doses of ionising radiation, transportation of radioactive substances, radioactive waste management and decommissioning, other nuclear installations including spent nuclear fuel storage facility and National Action Plan with proposed measures following the accident at the Fukushima Daiichi NPP. In addition, the issues of the SÚJB strategy, policy and transparency have been discussed during the mission.

In particular, the set of measures adopted to strengthen the safety of nuclear power plants in the Czech Republic based on an in-depth review following the accident at the Fukushima Daiichi NPP has been thoroughly examined by the members of the mission. The National Action Plan for the strengthening the safety of nuclear installations in the Czech Republic has already been adopted at the time of the mission and gradually implemented. The members of the IRRS mission noted that the Czech authorities have adequately assessed the lessons learned from the accident and defined and scheduled the necessary corrective measures in both technical and legal areas.

In their summary at the close of the IRRS mission, the international experts marked the regulatory system for nuclear safety and radiation protection in the Czech Republic as robust and the SÚJB as an effective and independent regulatory body, respectively. The international experts concluded that the SÚJB employs technically qualified and well-motivated staff. In several areas, the experts of the team appreciated the activities carried out by the SÚJB as good international practice, which they recommend to other countries. They also presented some recommendations, which should contribute to strengthening and improving the efficiency of the system of regulation of peaceful utilization of nuclear energy in the Czech Republic. Immediately after the evaluation mission, the SÚJB started work on drafting the internal Action Plan, under which the measures proposed by the IAEA mission are implemented in the Czech Republic.

IRRS Follow-up mission

The implementation of the results of the IRRS mission held in 2013[4] [8-2] was examined by the follow-up mission in May 2017. The IAEA team of experts assessed the quality of the national regulatory framework and its compliance with the Safety Standards of the Agency. The next review assessed the extent to which the Czech Republic, especially the SÚJB, cope with the recommendations and findings

[4] The full text of the report of the IRRS Follow-up mission can be found here: www.sujb.cz/fileadmin/sujb/docs/aktualne/Mise-IRRS/IRRS_Follow-up_Czech_Republic_Report.pdf

of 2013. During the mission, the SÚJB experts provided the foreign experts with an explanation of the current state of the new Czech nuclear legislation and regulatory procedures of the SÚJB.

The IRRS expert team stated the successful completion of most of the requirements of 2013. In conclusion of the mission, representatives of the international agency stated that the new Atomic Act constitutes a solid basis for a robust safety framework and the Czech Republic has made a considerable progress, especially in the field of human resources, long-term strategies, inspections, and enforcement of legislative requirements. Only the topics of the management system of the administrative authority, whose implementation is underway and should be completed in the coming years, remain open. Beyond the initial findings, the mission recommended considering developing rules for taking corrective measures in the case of existing exposure situations. International experts highlighted SÚJB's openness and direct communication with the public, in particular via the Internet, as good practice.

The next IRRS mission is scheduled for May 2023.

Statement on the implementation of the obligations concerning Article 8 of the Convention

The independent position of the SÚJB, as a regulatory body within the state administrative structure of the Czech Republic, its power and competency, and financial and human resources fully conform to Article 8 of the Convention.

Fig. 8-1 Organisational chart of the State Office for Nuclear Safety

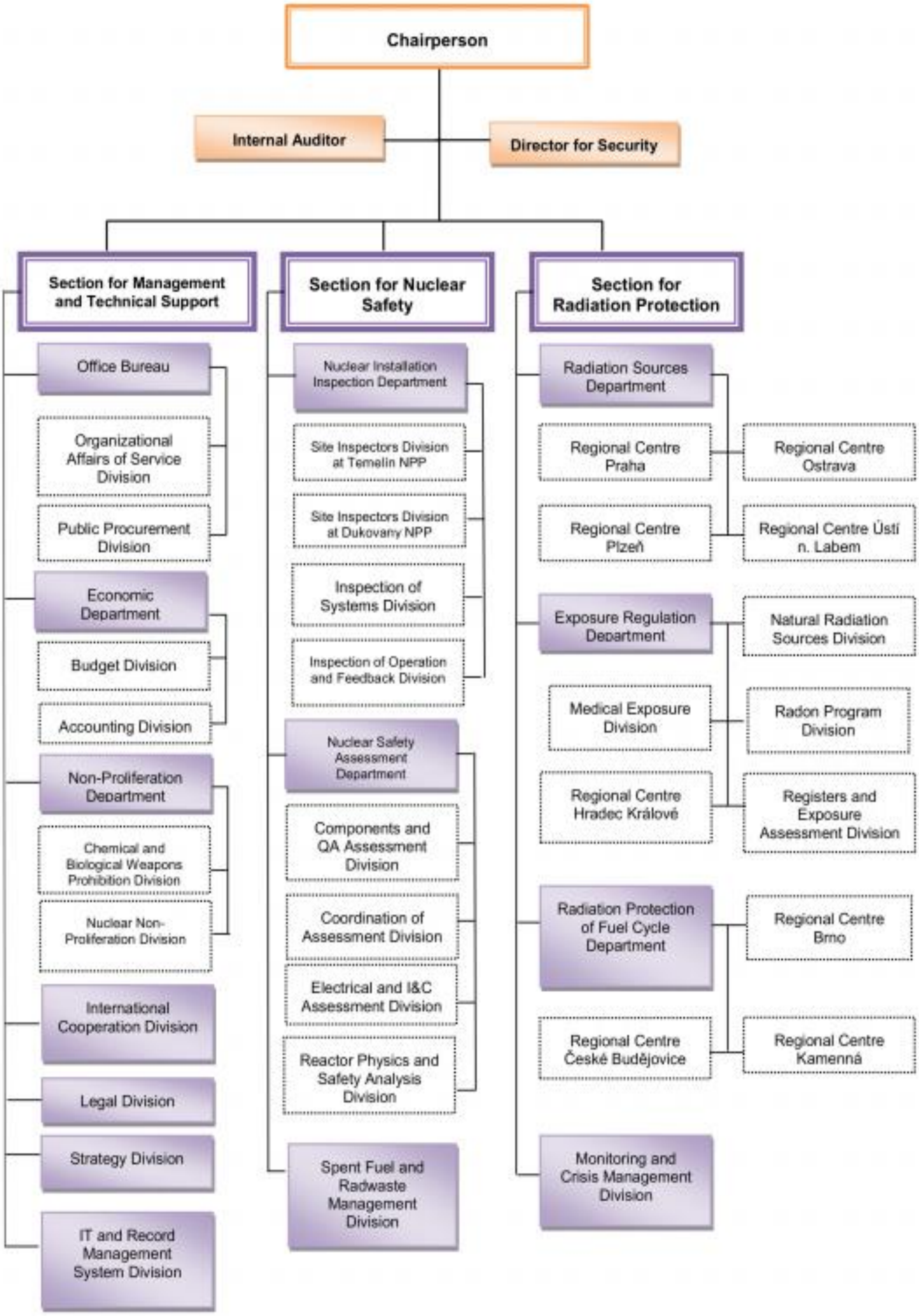
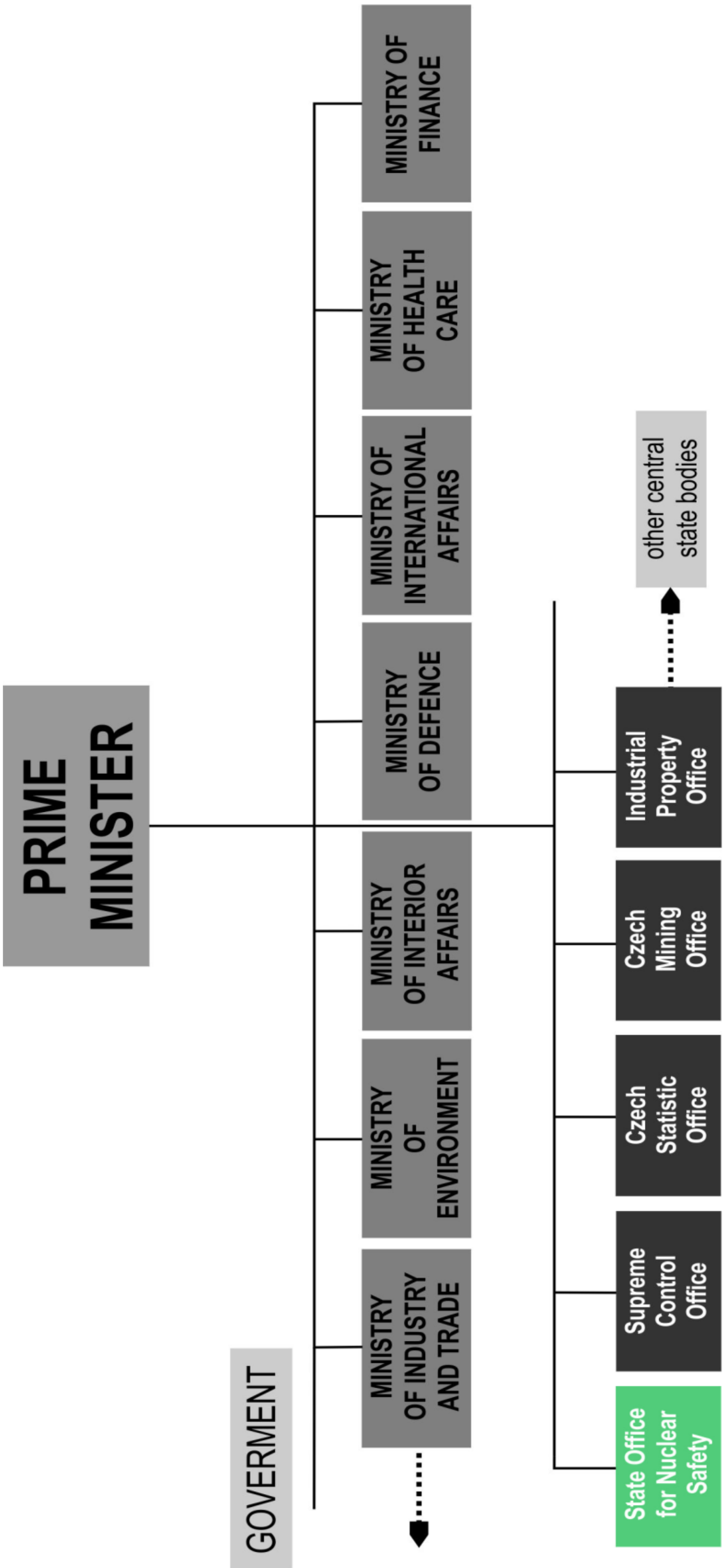


Fig. 8-2 The statute of the SÚJB within the aadministrative structure of the Czech Republic



9. RESPONSIBILITIES OF THE LICENCE HOLDER

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

9.1 Specification of duties and responsibilities

The current effective legislation of the Czech Republic represented particularly by the Atomic Act, consistently fulfils the principle of the primary responsibility of the licence holder for safety of a nuclear installation. This responsibility is reflected in the number of partial obligations of the licence holder representing in its complex an overall responsibility for safety.

The primary responsibilities in the use of nuclear energy or performance of the activities in the exposure situations are discussed in particular in the provisions of Section 5 of the Atomic Act. Anyone who uses nuclear energy or performs activities in exposure situations (i.e., in particular licence holders) shall, as a matter of priority, ensure nuclear safety, radiation protection, and safety of nuclear materials and other items in the nuclear field, which is important for ensuring the non-proliferation of nuclear weapons. This obligation cannot be transferred to another person.

Anyone who uses nuclear energy or performs activities in exposure situations shall, when new relevant information is acquired about the risks and consequences of these activities, evaluate the level of nuclear safety, radiation protection, technical safety, radiation extraordinary event management and security, and take measures to satisfy the requirements under this Act, and continuously and comprehensively evaluate compliance with the principles of the peaceful uses of nuclear energy and ionising radiation from the perspective of the present level of science and technology and ensure that the results of the evaluation are applied in practice.

Obligations common to licence holders and registered persons are set out in Section 25 of the Atomic Act; for example, licence holders and registered persons shall:

- notify the SÚJB without delay of any changes or events relevant to nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, security, and management of nuclear materials,
- investigate without delay any breaches of this Act, take corrective action, and prevent the recurrence of such situations,
- comply with the technical and organisational conditions for the safe operation of nuclear installations and workplaces with an ionising radiation source, and technical and organisational conditions for the safe management of sources of ionising radiation,
- assess nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security.

Obligations related to the management system are set out in Sections 29 through 32 of the Atomic Act.

9.2 Fulfilment of the requirements for primary responsibility for safety by the licence holder

The holder of a licence for the operation of Dukovany NPP and Temelín NPP is the ČEZ, a. s., which has the primary responsibility for the nuclear safety of its nuclear installations. The licensee has its own inspection system in place to check the fulfilment of requirements of the Atomic Act. In accordance with the Management System Program and other documents of the licensee, the check of observance of the duties laid down in the Atomic Act is ensured.

Based on the system, in case of an event related to nuclear safety, radiation protection, security, radiation extraordinary event management, and technical safety, the events' importance for nuclear safety is registered and investigated by the licensee, and remedial measures are introduced to prevent their repeated occurrence. The licensee shall immediately communicate these events to the SÚJB. Non-significant safety related events are also the subject of investigation and in such cases the investigation results, including the adopted remedial measures to assure that the events are not repeated, are subsequently transmitted. The whole process is regularly and systematically evaluated and monitored by the SÚJB inspectors.

The level of nuclear safety, radiation protection, security, radiation extraordinary event management, and technical safety is continuously assessed using the system of internationally comparable indicators. The safety assurance is also subject to the external independent mission, for example, performed by the IAEA and the WANO. Results of the IAEA assessments are transmitted to and discussed with the SÚJB.

The licensee continuously verifies and updates all documents, which represent the basis and condition for issuance of the licence, in particular, the Safety Report and safety analyses. These updates are submitted to the SÚJB for appraisal regularly.

As a part of the cooperation of Dukovany NPP and Temelín NPP with similar nuclear power plants currently in operation in Jaslovské Bohunice and Mochovce in the Slovak Republic, there are periodic exchanges of experience and knowledge associated with operational audits, similar to the WANO Peer Review, or the OSART.

The major responsibilities of the licence holders include the liability of the operator for nuclear damage caused by the operation of its nuclear installation, which is addressed in Act No. 18/1997 Coll.

For additional information on the fulfilment of the requirements of the Atomic Act by the licence holder see Chapter 19 hereof.

9.3 Inspection of compliance with primary responsibility for safety

One of the main tasks of the state supervision of nuclear safety is the monitoring of fulfilment of and adherence to the above-mentioned requirements. The persons providing inspections shall be SÚJB inspectors. The rights and obligations of inspectors are defined in Sections 200 through 205 of the Atomic Act and Act No. 255/2012 Coll., on Inspection. In agreement therewith, the inspectors check compliance with the requirements for and conditions of nuclear safety, radiation protection, security, radiation extraordinary event management, technical safety, and the nuclear installation conditions, adherence to the Limits and Conditions and operating procedures, and demand evidence of the fulfilment of all the established obligations.

To assure continuous supervision and complex awareness of the regulatory body about the situation in nuclear power plants, and to perform the *de facto* continual inspection activities, personnel of the SÚJB are present at both Dukovany NPP and Temelín NPP – the so-called "site inspectors".

For further description of the continued supervision of the licence holders see Chapters 7 and 8 hereof.

9.4 Communication with the general public and public awareness

The ČEZ, a. s., has been making substantial efforts on a long-term basis to establish friendly and mutually beneficial relationships with the towns, municipalities, and population in the vicinity of the power plants. These relationships are based on confidence and honesty, and the public has thus the opportunity to make sure of the fulfilment of safety priorities during the operation of nuclear power plants in the Czech Republic. It communicates very openly with the public through the media and has a wide range of educational programs.

Dukovany NPP – communication with the general public

In the region of Dukovany NPP, representatives and residents of municipalities living in the plant's vicinity and the general public have been allowed to inspect the plant's premises, including the spent nuclear fuel interim storage facility, and their questions and comments have been answered.

Important tools in this effort are as follows:

- An Information Centre of the power plant is visited by over 35,000 people each year, including those coming from abroad and systematic cooperation between the plant and elementary and secondary schools and universities.
- A Civil Safety Commission (OBK) of the Dukovany NPP, established by the Energoregion 2020 made up of municipalities from the 20 km zone around the power plant.

The OBK members are technically qualified and professionally trained persons from the ranks of mayors, councillors, and citizens of the region. Since its establishment in 1996, the OBK has the right to conduct independent inspections of the nuclear power plant, its members have unattended access to the Dukovany NPP and provide independent information to the general public. For these purposes, the OBK have their own websites[5] and annually organizes a seminar on the evaluation of power plant operation. The commission has been chaired by Aleš John since 2013, a long-time member of the WANO.

At least four sessions of the Civil Safety Commission are held every year to continue to systematically educate the members of the Civil Safety Commission in the nuclear area and inform about the operation and current situation in the Dukovany NPP and the nuclear area. The members of OBK as well as representatives of other organizations in the region receive experience from operating nuclear power plants also through tours to nuclear installations in the Czech Republic and in Europe. Every working day, the OBK members receive e-mails with information about the operation of Dukovany NPP. Representatives (mayors) of all municipalities within the 20 km protection zone of NPP receive actual information on the situation at the Dukovany NPP and a summary of reports once a week and once a month, respectively. Several years ago, the good practice of the Civil Safety Commission inspired the Slovak Republic to establish OIK (Civil Information Commission, OIK Bohunice and OIK Mochovce) and in 2013, the uranium mining site in the Czech Republic, the Bystřice microregion, to establish another local Civil Safety Commission. All such civil initiatives cooperate.

The Energoregion 2020 organizes 140 municipalities from the 20 km protection zone of the Dukovany NPP, headed by Vladimír Měrka, who is the Chairman of the Association and the Mayor of the City of Náměšť nad Oslavou at the same time.

- The Ekoregion Association organizes municipalities within the 5 km zone of the Dukovany NPP and its Chairperson is Petra Jílková, the Mayoress of one of the municipalities – Rešice.
- Mayors of the Rouchovany and Dukovany municipalities are active members in the Group of European Municipalities with Nuclear Facilities (GMF) – European Association organizing municipalities and towns where the nuclear installation is located)[6].
- The initiative “Nuclear Regions of the Czech Republic” together with other regional societies protects the interests of citizens and municipalities at political and interest fora of the European Union and the Czech Republic. Since 2013, the initiative has been headed by Vítězslav Jonáš, former mayor of the municipality of Dukovany and senator for the district of Třebíč.

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[5] www.obkjedu.cz
[6] www.gmfeurope.org

- There is a website[7] www.aktivnizona.cz available to the public. The following domains operate on social networks: ČEZ Lidem, www.kdejinde.cz, Pro jádro (Facebook), www.3pol.cz, and other domains with energy and nuclear topic.
- The public in the region is regularly informed about the current situation at the nuclear power plant through the printed periodical publication "Zpravodaj", which is distributed by the power plant with a print run of 40,000 issues four times a year to every household within 20 km from the power plant. In 2018, a new SMS information system was launched, where any interested person can voluntarily register to receive the actual news from the power plant.
- Open communication with representatives of the media. Meetings with journalists and press conferences concerning important topics and visits are held. Concerning maximum openness and awareness, journalists are allowed to make special visits and reports directly from power plant operations.
- Creating and strengthening relations between the power plant and its vicinity include strong economic aid to municipalities, improvement of the conditions of life and support of various social organizations and institutions in the form of donations and advertising activities.
- Following the operation of the Dukovany Nuclear Power Plant, several independent civil associations operate in support of the nuclear power industry, such as WIN – Women in Nuclear or JARO – Association of Nuclear Parents, which organize webinars and other activities aimed at educating and at presenting the industry.
- The foreign-country-oriented cooperation with crisis units of the country of Lower Austria neighbouring the region of Dukovany NPP is reduced, but it is possible to follow up the past activities at any time.

Temelín NPP – communication with the general public

The communication strategy of the Communication Division at Temelín NPP set down key target groups of the population. The groups are addressed using a broad mix of above-the-line and below-the-line communication facilities. The most important group exchanging information on an intensive basis is made up of mayors of 33 municipalities within 13 km of the emergency planning zone around Temelín NPP. Apart from personal contacts, the power plant organizes annually 4– 6 working meetings with the mayors in the presence of the power plant and ČEZ, a. s., company management. At the meetings, the mayors acquire information on the operation of units, and their safety or power plant plans for the following period or status of the project for the construction of a new unit. A part of the communication with elected representatives includes visits to power plant premises and ČEZ, a. s., organizes 1-2 a year, orientation tours to other nuclear installations in the Czech Republic and in Europe. The communication with elected representatives of the South Bohemian region is carried out similarly.

Inhabitants and visitors to the 13 km emergency planning zone form directly another significant group. These are primarily addressed through systematically built programs Orange Year and Temelín Power Plant – Your Good Neighbour, which aim at promoting cultural, social and sports events or supporting the region. In 2018, the power plant introduced a new communication channel – a SMS gateway that allows sending SMS messages and short messages to registered users. The power plant thus informs directly registered users, for example, about the tests of sirens or technologies that could be heard around the power plant.

The Information Centre of Temelín NPP, which has been operating since 1991 and which moved to renovated little castle Vysoký Hrádek in 1997, is used to inform the general public and especially schools. Modern methods of presentation such as 3D projection, interactive models, etc. are used therein. Technical equipment in the Information Centre enables the preparation of "tailor-made" programs for individual groups of visitors. The Information Centre is visited by approximately 40,000

[7] www.cez.cz

people each year, with approximately 6 % of visitors from foreign countries. Thus, for many years the Information Centre has ranked among the ten most visited monuments of the South Bohemian Region and helps to support tourism.

Through the activities carried out by the Information Centre of the Temelín NPP, the ČEZ, a. s., addresses another target group – primary and secondary schools, and universities in the region. Educative programs focused on a wider scale on technical education are specifically prepared for them. For example, significant is cooperation with teachers and lecturers in technical and scientific fields, who make use of visits, traineeships and reciprocal lectures. Cooperation with schools was extended in 2015, in compliance with the requirements of the state to promote technical education, to even include work with final-year children in kindergartens.

Due to anti-epidemic measures and the closure of information centres in 2020 and 2021, the ČEZ, a. s., prepared virtual online tours. At the time of the closure of the information centres, almost 45,000 people, mostly primary and secondary school pupils and students, visited the power plants.

The Prime Ministers of the Czech Republic and the Republic of Austria concluded the so-called “Melk Protocol” on the exchange of information between both states in the matter of the Temelín NPP operation in December 2000 in Melk. Several expert negotiations took place under this Protocol. The Temelín NPP also sends daily reports on its operation to the Austrian party, which are presented in Czech and English language on the ČEZ, a. s., website.

The representatives of the media receive daily information about operation and press releases are issued on important topics. Meetings with journalists and press conferences are held. A very frequent method of communication is to enable coverage just from the power plant. At least thirty newspaper reports take place a year. Daily communication, with the representatives of regional editorial offices, is assured by press officers. The Temelín NPP publishes more than 150 press releases per year.

Bulletin “Temelínky” has been issued for 30 years already in an edition of 23 thousand copies, which is, three times a year, distributed to every household in 33 municipalities of the emergency planning zone. At the same time, the Communication Division of the Temelín NPP operates a news web portal www.ete.cz and communicates its activities through its profiles on social networks. Since 2000, the brochure in the form of a calendar has been issued including the instructions for behaviour in case of an extraordinary event in the power plant. It is distributed once in two years to the population in the surroundings of the power plant.

Following the operation of the Dukovany Nuclear Power Plant, several independent civil associations operate in support of the nuclear power industry, such as WIN – Women in Nuclear or Jihočeští taťkové (South Bohemian Fathers) – an association which organizes seminars and other activities aimed at educating and presenting the industry.

9.5 Responsibility of the licence holder for radiation extraordinary event management

The issue of responsibility of the licence holder for ensuring radiation extraordinary event management or sufficient resources (technical, human, financial) to mitigate the radiation extraordinary event in a nuclear installation is covered in Chapter 16 and Chapter 11 hereof.

Statement on the implementation of the obligations concerning Article 9 of the Convention

Current legal provisions dealing with the basic responsibility of licensees for nuclear safety in their nuclear facilities are defined in accordance with the requirements introduced in Article 9 of the Convention.

10. PRIORITY TO SAFETY

Each Contracting Party shall take appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

10.1 Entrenchment of the requirements prioritizing safety

In the Czech Republic, the SÚJB is responsible for state administration and supervision of the utilization of nuclear energy and ionising radiation and in the field of radiation protection and other fields defined by the legislation in force. The competence of the SÚJB is defined in the Atomic Act.

The priority principle of nuclear safety is set out in Section 5 (Principles of the peaceful use of nuclear energy and ionising radiation) of the Atomic Act, where, for example, pursuant to paragraph 2:

Anyone who uses nuclear energy, manages a nuclear item or performs activities in exposure situations shall

a) as a matter of priority, ensure nuclear safety, safety of nuclear items. and radiation protection, while respecting the present level of science and technology and good practice,

b) perform assessment of intention to perform activity and of its expected results from perspective of their benefits for the society and individuals (hereinafter “justification”),

c) within the justification take into consideration techniques which do not use nuclear energy and ionising radiation, but which can provide comparable results,

d) perform only activity with benefits for the society and individuals prevailing over a risk emerging from the activity or its consequences; such activity is considered as justified, and

e) perform justification repeatedly whenever new and important evidence about the efficacy or potential consequences of the activities performed or new and important information about other techniques or technologies is available.

These principles are further discussed in other parts of the Atomic Act, in particular “General rules for the safe use of nuclear energy”.

The Atomic Act and its implementing regulations cover the entire life cycle of a nuclear installation from the siting and design through construction and operation to decommissioning. These include but are not limited to:

- ***Decree No. 379/2016 Coll.,*** concerning the approval of some products in the field of peaceful use of nuclear energy and ionising radiation and the carriage of radioactive or fissile material.
- ***Decree No. 378/2016 Coll.,*** on siting of a nuclear installation.
- ***Decree No. 377/2016 Coll***., on the requirements for the safe management of radioactive waste and on the decommissioning of nuclear installations or category III or IV workplaces.
- ***Decree No. 376/2016 Coll.,*** on dual-use items in the nuclear area.
- ***Decree No. 375/2016 Coll.,*** on selected items in the nuclear area.
- ***Decree No. 374/2016 Coll***., on the accountancy and control of nuclear materials and reporting of information on them.
- ***Decree No. 361/2016 Coll.,*** on security of nuclear installation and nuclear material.
- ***Decree No. 360/2016 Coll.,*** on radiation situation monitoring.
- ***Decree No. 359/2016 Coll***., on details of ensuring radiation extraordinary event management.

- ***Decree No. 358/2016 Coll.,*** on requirements for assurance of quality and technical safety and assessment and verification of conformity of selected equipment.
- ***Decree No. 408/2016 Coll***., on management system requirements.
- ***Decree No. 409/2016 Coll***., on activities especially important from nuclear safety and radiation protection viewpoint, special professional qualification and training of persons ensuring radiation protection of the registrant.
- ***Decree No. 422/2016 Coll***., on radiation protection and security of a radioactive source.
- ***Decree No. 21/2017 Coll.,*** on ensuring nuclear safety of a nuclear installation.
- ***Decree No. 162/2017 Coll.,*** on requirements for safety assessment according to the Atomic Act.
- ***Decree No. 329/2017 Coll.***, on the requirements for nuclear installation design.

The scope, content, rules and inspection activities of the SÚJB are further incorporated into the internal organizational regulations of the SÚJB (VDI, VDK, VDS); with the basic organizational norm being VDK 01 – SÚJB Rules of Organisation.

10.1.1 Safety policies

The safety policies are based on the Strategy of the SÚJB. The objective is an independent, professional, widely respected and trusted governmental administration for the prevention and elimination of risks arising from the use of nuclear energy and ionising radiation and non-proliferation of weapons of mass destruction.

- Safety principles concerning the competence of the SÚJB are the default layer for safety management at the level of the SÚJB and are particularly contained in legislation. Safety principles in particular in the area of nuclear safety and radiation protection are based on the "Safety Fundamentals" issued by IAEA.
- Elaborating the safety principles gives rise to the "Safety Culture" of the SÚJB containing the principles of protection and safety.
- The third layer of the management system in the area of safety is made up of safety requirements It concerns the requirements based on the standards referred to in Chapter 9. Standards Introduced in the Management System.
- Specific safety measures are introduced for the selected activities in the area of safety.

Safety priority is one of the main priorities of the SÚJB. To ensure safety priority during its activities the SÚJB operates the Integrated Management System, which in accordance with the quality policy introduces the requirements laid down in GSR Part 2 into the control documentation (Organizational Standards VDI, VDK, VDS), in particular:

- VDK 001 Organisational Rules of the SÚJB,
- VDK 099 SÚJB Integrated Management System Policy,
- VDK 100 SÚJB Integrated Management System Manual.

The policy of the SÚJB sets out the fundamental principles of safety culture, which have to be respected during all activities carried out by the SÚJB:

- clear management structure and distribution of responsibility;
- transparency during all activities, including decision-making process;
- continuous confidence building on the part of stakeholders;
- training of highly qualified experts and good motivation of the SÚJB staff;
- continuous improvement.

10.1.2 Safety culture programs

The requirement for the implementation of the Safety Culture Program and its development is based on the Atomic Act, where it is one of the requirements for the Management System. Pursuant to Section 30(7) of the Atomic Act, the licence holder shall develop a healthy safety culture. Coherent and systematic activities for the development of the safety culture are called “Safety Culture Development Program”.

In this respect, the licence holder has a relative freedom as to the appearance of its own program. Here are the basic points to be met by the program:

a) Commitment to safety– documented commitment of the licence holder and its management to ensure a high level of safety supported by clear safety objectives. This is in the top management documentation and includes commitment to provide the necessary resources to achieve them.
b) The current level of safety culture is regularly identified and evaluated.
c) Adequate resources are earmarked for education, dissemination and popularization of basic knowledge about safety culture among all employees.
d) Monitoring, evaluation and improvement of safety culture are carried out in various ways.
e) The licence holder shall ensure that these requirements are applied to an adequate extent even by its contractors and subcontractors.
f) Persons responsible for the Safety Culture Development Program have sufficient powers to enforce the necessary steps to fulfil the responsibility undertaken.

10.1.3 Arrangements for safety management

Arrangements for safety management are directly based on legislation, in Decree No. 162/2017 Coll., on requirements for safety assessment, which incorporates the relevant provisions of the Euratom and sets out:

- rules for the implementation of safety assessment and individual types of assessment and time limits in which they are implemented,
- method of documenting the safety assessment and individual types of assessment and content of the documentation of safety assessment and individual types of assessment, and
- method of using safety assessment.

10.1.4 Arrangements for safety monitoring and self-assessment

The arrangements for safety monitoring and self-assessment are set out in the control documentation by the SÚJB, namely VDS 036 Review and assessment of own activities. Its purpose is to establish principles for the assessment of internal activities and review of output documents and records of the SÚJB related to the performance of supervision of nuclear safety, radiation protection, nuclear materials including physical protection, and emergency preparedness.

The priority to safety is also reflected in the Code of Ethics of the SÚJB staff.

10.1.5 Independent safety assessment

The independent safety assessment takes place at multiple levels.

The basic level is the assessment of all operational events at nuclear power plants to be notified to the SÚJB by independent experts, which takes place as one-stage or two-stage assessment depending on the seriousness of the event. The first stage takes place for all events after the submission of basic information about the event by the licence holder. The second stage of assessment takes place for events where legislation requires the licence holder to determine root causes of the event in event analysis, and takes place after the submission of the analysis of these events by the licence holder to the SÚJB.

Furthermore, independent *ad hoc* assessments can be conducted for events:

- with unclear conclusions of the investigation by the licence holder,
- which seem to be safety-relevant based on their evaluation using the PSA.

10.1.6 Discussion on measures to improve safety culture

Measures to improve safety culture are the full responsibility of the licence holder. The SÚJB approaches to this part of the implementation of the Safety Culture Development Program through a regulatory approach based on three pillars recommended by the IAEA and described, for example, in IAEA-TECDOC-1707. These pillars are as follows:

- Common understanding of safety culture. The nature of safety culture is different from the application of legal regulations to technology. Understanding these differences and uniqueness is critical to achieving a common language and method of communication between the licensee and the regulatory body. This common understanding then becomes a peculiar instrument for promoting the importance of safety culture in ensuring nuclear safety.
- Dialogue. To better understand the safety culture, it is necessary to share information in an open dialogue and share ideas and knowledge, which are often qualitative in nature. Dialogue on mutual roles of both parties promotes creative and constructive way of finding solutions for continuous improvement of safety.
- Continuity. Developing a healthy safety culture requires sustained commitment and involvement of the licensee. Oversight of the regulatory body of safety culture responds to internal processes of the licensee, while affecting them as one of the independent inputs of information.

10.1.7 Process-oriented management system

Process orientation of the management system of the SÚJB is set out in the Integrated Management System and is regulated by internal documents, in particular:

- VDS 001 Organisational Rules of the SÚJB,
- VDK 099 Integrated Management System Policy,
- VDS 100 SÚJB Integrated Management System Manual.

Process orientation is one of the principles of Integrated Management System:

- The priority of management system is to ensure nuclear safety and radiation protection as well as control of the prohibition of chemical and biological weapons and nuclear non-proliferation.

This priority is matched to the organizational structure of the SÚJB (see Fig. 8-1) and serves as a basis for the quality policy of the SÚJB, which explicitly states that the main principles of safety culture to be respected in all activities of the SÚJB are as follows:

- Clear management structure and distribution of responsibility;
- Transparency during all activities, including decision-making process;
- Continuous confidence building on the part of stakeholders.
- Training of highly qualified experts and good motivation of the SÚJB staff;
- Continuous improvement.

10.2 Ensuring the priority of safety by the licensee

In accordance with the valid legislation as well as the international obligations of the Czech Republic, the ČEZ, a. s., accepts responsibility for safety assurance at its nuclear power plants, staff and public protection, and environmental protection. In order to fulfil this responsibility, the company undertook to create and further develop conditions with sufficient human and financial resources, effective management structure and control mechanisms.

In September 2017, an organizational change was made in the ČEZ, a. s., which divided the former Production Division into the Nuclear Energy Division (DJE) and the Conventional Energy Division, thus separating nuclear activities from non-nuclear activities, originally ensured in the Production Division. This change has created better conditions for the performance of Chief Nuclear Officer function, strengthening the responsibility for the management of activities related to the use of nuclear energy (nuclear activities) in the ČEZ, a. s., including the allocation of adequate powers and competences. The Director of Nuclear Energy Division was appointed by another member of the Board of Directors of ČEZ, a. s., with the Units of Safety, Management of NPP Technology, Management of NPP Assets, NPP Construction, Staff Training, and both nuclear power plants reporting to him.

Safety requirements for nuclear installations are given top priority in the company and these requirements exercise decisive influence on all commercially strategic priorities and main objectives (long-term as well as short-term) focused on operationally safe and reliable power and heat generation.

Safety strategy adopted in the ČEZ, a. s., focuses on continuous fulfilment of basic safety goals and nuclear safety principles (included in the internal control documents of the company in accordance with the international standards, experience and recommendations and in accordance with the valid legislation of the Czech Republic) with maximum use of safety culture principles and quality assurance requirements. To achieve the strategy goals, all employees were and still are acquainted with this strategy in detail.

The company keeps developing the conditions for fulfilment of the above safety obligations (strategic goals) in compliance with the declared Policy of Safety in Nuclear Activities of the ČEZ, a. s., internally drafted and declared by the decision of the Board of Directors of the company.

Target fulfilment of the obligation of superior position of the requirements for safety and environment protection to the requirements of production as well as fulfilment of the obligation concerning continuous improvement of safety culture also includes yearly updated strategic tasks of the Chief Executive Officer and Director of Nuclear Energy Division of the ČEZ, a. s., as well as the tasks of separate programs and Plans for Safety Enhancement for both NPPs.

The basic framework of the powers and responsibilities and the method of assurance of the activities performed for fulfilment of all safety obligations within the company, are defined by the control documents: Organizational Structure, Mission and Tasks of the Units, Management System Program for Operation, Manual of Integrated Management System and Safety Management in ČEZ, a. s. The above control documents describe, in terms of organization and process, control mechanism of activities in the fields with performance of activities important to nuclear safety.

One of the tools for systematic assessment of the level of nuclear safety is a set of indicators, which characterize trends of the nuclear safety level and the radiation protection level in nuclear power plants during the past week, month, year. Through the monitoring of indicators, the company's managers thus obtain the feedback for assessment of safety requirement implementation success-rate.

In order to support the solution to the most significant (principal) safety issues related to the operational safety of nuclear installations, advisory committees of the Chief Executive Officer and Director of Nuclear Energy Division operate at the top management levels of the ČEZ, a. s., Directors of the nuclear power plants and selected central special departments as well as invited specialists and visitors work in the advisory committees (Committee on the Safety of ČEZ, a. s., Committee on the Safety of Nuclear Energy Division, and Committees on the Safety of Nuclear Power Plants). The basic function is to evaluate the safety level of nuclear installations and to identify the topical and potential safety related problems together with their assessment and subsequent recommendation for optimal solution proposals.

The ČEZ, a. s., has established its general commitment to safety as the first of the five company principles. For assessment and development of the nuclear safety culture, see Annex 5.

10.3 SÚJB procedures to inspect the safety priorities of the licensee

These procedures are set out in the internal organizational regulations of the SÚJB:

- VDS 008 Planning, implementation and evaluation of inspection activities in nuclear installations,
- VDS 037 – Implementation of the inspections,
- VDS 040 Rules for radiation protection inspection at nuclear power plants.
- VDS 041 Independent monitoring of discharges and surrounding areas of ionising radiation source workplaces.
- VDS 043 Planning, preparation, implementation and evaluation of inspection activities – Radiation Protection Section sets out the framework rules for the scope, planning and implementation of inspection activities of the SÚJB.
- Detailed content, scope, and instructions for implementing the various inspections or inspectional Areas are also set out in VDS 063 to 084.

10.4 Means used by the regulatory body to prioritize safety in the SÚJB activities

The means are based on the Strategy of the SÚJB, where the main values include Independence, Professionalism, Openness and Credibility, which are based on the following principles:

- implementation of new atomic legislation, both internal, i.e. implementation of the new Atomic Act, and external, i.e. transposition of the latest regulations of Euratom, IAEA and WENRA recommendations,
- ensuring competent human resources, whose long-term development is based on clearly defined competencies of the employees of the SÚJB,
- maintenance of the continuity of processes, an integral part of which is timely transfer of achieved know-how to junior workers,
- focus on communication with the general public,
- exploitation of the results of science and research, the centre of which is in public research institutions, established by the SÚJB.

In addition, these means are directly based on the mission of the SÚJB, as the regulatory body for nuclear safety, nuclear items, physical protection of nuclear installations, radiation protection, and emergency preparedness of nuclear installations. This is performed through:

- continuous monitoring of the operation of nuclear installations and definition of the rules for notifications of events (types of notified events, the time limit within which the event must be notified) in nuclear installations by the licence holder to the SÚJB,

- inspection activities, both regular inspections carried out as planned, and unplanned "*ad hoc*" inspections after the occurrence of serious events, at least in the case of:
    - events classified as INES 2 or higher,
    - events classified as INES 1, if they prove serious upon their primary analysis by the SÚJB physical specialists,
    - events with unclear findings of the investigation by licensee, in particular in the field of violations of the Limits and Conditions,
    - events which seem to be safety-relevant based on their evaluation using the PSA.

Statement on the implementation of the obligations concerning Article 10 of the Convention

The principle of priority to safety, as established in Article 10 of the Convention, has been complied with in the Czech Republic.

11. FINANCIAL AND HUMAN RESOURCES

(i) Each Contracting Party shall take appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.

(ii) Each Contracting Party shall take appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.

11.1 Financial resources

11.1.1 Financial provision of nuclear safety enhancement at nuclear installations in the course of their operation

The Atomic Act establishes as one of the general conditions for anyone performing or providing the practices related to nuclear energy utilization that he shall have an implemented management system to the extent and in the manner set out in an implementing regulation (Section 29 of the Atomic Act). This regulation is Decree No. 408/2016 Coll., on management system requirements. Management Assurance Programs for the licensed activities shall be approved by the SÚJB.

Documentation of the licensee's – ČEZ, a. s. – management system includes the commitment to arrange the sufficient financial resources available to assure the safe operation of the company's nuclear power plants. This commitment is included in the Organization Rules of ČEZ, a. s. In connection with ČEZ, a. s., Safety and Environmental Protection Policy, the provision of sufficient resources for assurance of nuclear safety and staff protection as well as environmental protection has been described in detail in the relevant control documents.

Safety maintenance and enhancement in the nuclear power plants operated by the ČEZ, a. s., are ensured in the controlled manner. Financial planning of resources to assure and improve the level of safety of nuclear power installations (strategic plan, business plan and annual budget) is carried out in line with the Management System of the ČEZ, a. s., and ensuring safe and economic operation of nuclear assets forms an integral part thereof.

In the field of management of the existing nuclear assets (Asset Management), the necessary financial resources are allocated based on the life and reliability management programs, and the associated and approved long-term maintenance programs, from which the relevant annual maintenance plans are generated.

Where ensuring of specific projects (specific actions) is needed, business plans and project plans are particularly prepared, which are assessed as a matter of priority in terms of their impact on safety and are subject to approval at the Nuclear Energy Division management and company management levels of the ČEZ, a. s., according to the Signature Rules. The individual projects are subsequently incorporated into the company budgets for the relevant year. Funding of the individual projects is provided from the company's unrestricted sources.

11.1.2 Provisions for assurance of financial and human resources for the decommissioning of nuclear installations and management of radioactive waste generated during their operation

Radioactive waste

The management of radioactive waste including that one generated at nuclear power installations is regulated by Section 4 of the Atomic Act (Sections 106 – 117). Section 111(1) a) and d) of the Atomic Act clearly states:

“Holders of a licence for the radioactive waste management or producers of radioactive waste, if radioactive waste was not handed to the holder of a licence for the management of radioactive waste, shall bear all the costs associated with the management of radioactive waste, from its generation to disposal; including the monitoring of radioactive waste repositories after their closure and the necessary research and development activities; these costs shall be financed by fees paid to the nuclear account maintained by the Czech National Bank.”

The amount and method of payment of fees to the nuclear account are defined in Title V of the Atomic Act. The nuclear account, which is part of the state financial assets, is administered by the Ministry of Finance. The funds on the nuclear account may only be used for the purposes specified in the Atomic Act.

In order to ensure activities related to the storage of radioactive waste, the Ministry of Industry and Trade established the SÚRAO, which is in accordance with Act No. 219/2000 Coll., on Assets of the Czech Republic and its acting in legal relations, the state organization from January 1, 2001. Activities of the Radioactive Waste Repository Authority are carried out under the government approved statute, budget and annual, three-year and long-term plan of activities. Activities of the Radioactive Waste Repository Authority shall be funded from the so-called “nuclear account” through the state budget. Such funds together with the income from Authority operations are subject to annual settlement to the nuclear account.

Radioactive waste management in nuclear power plants of the ČEZ, a. s., is executed by separate organizational units (their activities also include the issue of inactive waste management, decontamination and the release of waste from the workplace) integrated into the Safety Unit under the Nuclear Energy Division. Staff training is conducted under the uniform training system (see Chapter 11.2).

Further information is provided in the National Report under the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, Revision 7.0, SÚJB, April 2020[8], [11-1].

Decommissioning

The basic obligations of a licence holder as specified in Section 51(2) of the Atomic Act include the obligation to steadily create financial reserves for the preparation and implementation of decommissioning of a nuclear installation. The reserve is determined according to the decommissioning plan approved by the SÚJB and the cost estimate verified by the Radioactive Waste Repository Authority for the decommissioning plan. The method of creating reserves is governed by a separate legal regulation issued by the Ministry of Industry and Trade of the Czech Republic.

Inspection of the creation of reserves and approval of the use of financial reserve is performed by the the SÚRAO. Currently, decommissioning plans for Dukovany and Temelín NPPs and the Spent Fuel Storage Facilities (Interim Spent Fuel Storage Facility Dukovany, Spent Fuel Storage Facility Dukovany and Spent Fuel Storage Facility Temelín) are approved. The financial reserves for decommissioning are created in accordance with legislation for all nuclear installations operated by the ČEZ, a. s. The funding for decommissioning of nuclear installations are held in the bound account and may only be used for the preparation and implementation of decommissioning in accordance with the Atomic Act.

The issue of decommissioning documentation preparation is assured at the licence holder – ČEZ, a. s., by permanent multi-professional work team consisting of the experts of Nuclear Energy Division and Administration Division whose knowledge and experience can be utilized in preparation of decommissioning. In terms of organizational structure, team members are the representatives of the Units of Fuel Cycle, Safety, Management NPP Technology and Management of NPP Assets. The team

[8] https://www.sujb.cz/en/reports

covers technical, financial, investment and organizational issues of decommissioning including the issue of assurance of the relevant human resources. Establishment of the team and all activities performed in this field are executed in compliance with the requirements for management system adopted within the ČEZ, a. s., and included in the relevant management system program.

Insurance

The Czech Republic joined the Vienna Convention on Civil Liability for Nuclear Damage and the Joint Protocol relating to the Application of the Vienna and Paris Conventions in 1995 (published in the Collection of Laws under No. 133/1994 Coll.).

In the period from 1994 to 1997, this field was covered by government declaration (guarantee). In 1997, the Atomic Act came into force stipulating liability of the operators of nuclear facilities for incurred damage and imposing the duty to take out an insurance (Articles 32-38) upon the operators, after the release of the Atomic Act, the wording regarding liability for nuclear damage were governed by Act No. 264/2016 Coll.

By virtue of Act No. 158/2009 Coll., the liability of the operator of the major nuclear facilities increased from original CZK 6 billion (approx. EUR 233 million) to CZK 8 billion (approx. EUR 310 million). The operator is now obliged to take out nuclear facility operation damage liability insurance with the minimum indemnity limit of CZK 2 billion (approx. EUR 78 million). This limitation of liability for damage is acceptable in terms of international commitments of the Czech Republic. In this field, the Czech Republic has yet ratified only the Vienna Convention (1963), which requires that the amount of liability of an operator is not lower than USD 5 million related to the value of gold. Thus, the current amount corresponds to this limit and it was increased in 2009 in order to approximate the limit set by the revised Vienna Convention of 1997, which determines the minimum amount of SDR 300 million. At present, the Czech Republic prospectively envisages the ratification of this revised Convention and the limits of liability will be therefore adapted to its text in future.

The Vienna Convention orders the introduction of obligatory liability insurance (or any other financial security) for operators of nuclear installations. The amount of indemnity limit is left to the Contracting States. The limit of CZK 2 billion for nuclear power installations (or CZK 300 million for other nuclear installations and transports) was determined depending on the number of nuclear installations in the Czech Republic, competence of the national nuclear insurance pool and potentials of the insurance market in this area (it is, after all, area outside of conventional types of insurance, where the real number of damage events is very low but has always the potential to have huge consequences).

The Atomic Act also specifies that the Czech Republic provides the guarantee for settlement of acknowledged claims for compensation of nuclear damage, unless they are reimbursed from the obligatory insurance or financial security otherwise established, up to a sum of limit of CZK 8 billion. Therefore, the amount of insurance limit was particularly determined depending on that such amount is still insurable and this obligation could be therefore in reality fulfilled by its addressees.

11.2 Human resources

Legislation

The Atomic Act sets forth conditions under which nuclear energy and ionising radiation may be utilized.

Section 49(1) n) of the Atomic Act sets out the following general obligation to the licensee: "to determine the qualification requirements for activities important to nuclear safety and provide for a system of education, training and practice for the personnel, including a register of the qualifications obtained and their verification with respect to the relevance of the activities performed."

Preconditions for performance of activities directly influencing nuclear safety are established by the provision of Section 31 to 33 of the Atomic Act. Such activities may only be performed by persons, who are physically and personally fit, with professional competence verified by the Examining Board and to whom the SÚJB has granted an authorization for the concerned activities, upon an application by the licensee.

Training and further training for the selected staff of nuclear installations may, according to Section 9(6) a) of the Atomic Act, be implemented only on the basis of the licence granted by the SÚJB. Documentation required for the issuance of such a licence is listed in an Appendix to the Atomic Act.

Decree No. 409/2016 Coll. in compliance with provisions of the Atomic Act, mentioned above, sets out activities specifically important to nuclear safety and radiation protection, requirements for qualification and professional training, method of verification of special professional competence and authorization process of the selected staff, as well as the format of required documents to obtain a licence for training of selected staff.

The legal regulations, above mentioned, have been complemented with the Safety Guide BN JB-1.3 issued in December 2010 by the SÚJB, covering professional education and training of staff for the performance of work activities (positions) at Czech nuclear installations. The Guide specifies criteria and provides methodical guidelines for management and execution of training of employees of nuclear installation operators and employees of legal and physical entities whose activities (positions) at nuclear installations are important to nuclear safety, with the objective to minimize risks caused by human failure.

Annexes to Decree No. 409/2016 Coll., set out the list of areas of theoretical knowledge and practical skills that are covered by the education and training required in the Czech Republic for the performance of inspection activities falling within the authority of the SÚJB.

Methods used for the analysis of competence requirements and training needs for all safety related activities in nuclear installations

The principles of systematic approach to training for staff, based on the analysis of the requirements for knowledge and skills of staff in terms of the required competencies defined in the job description, are applied to the analysis of requirements. The approach to training is systematic, which creates a logical process from the requirement through the creation of the training program, its application, evaluation and updating. The effectiveness of the training system is periodically evaluated.

Description of the system for initial training and retraining of operations staff, including simulator training

The aim of training of the staff of the NPPs operated by the ČEZ, a. s., is to fulfill the requirements resulting from the above mentioned legislation, thus securing necessary knowledge and skills of the management, operations staff and support staff.

The concept of training and further training is based on the requirement for staff knowledge and skills needed to perform the work activity. The guarantor for staff training in terms of the Atomic Act is, within the NPP operator – ČEZ, a. s. (licence holder), the Staff Training Unit, which is organizationally included in the Nuclear Energy Division. Its main mission is to conduct training and further training of staff performing the activities under the nuclear activities of ČEZ, a. s.

In accordance with the internal control documents of the licence holder, the Staff Training Unit is responsible for obtaining and maintaining the validity of the SÚJB licence for training of selected staff of nuclear installations and selected staff of workplaces with ionising radiation sources.

The activities of the Staff Training Unit are conducted in three training centres located in Brno and in the Dukovany NPP site and the Temelín NPP site.

Training of the NPP staff is closely related to the educational system in the Czech Republic. A significant proportion of employees are university graduates or technical high school graduates. The aim of the training and further training is to provide necessary knowledge and skills required to achieve, maintain and develop the competence of staff to perform the specified activities. Achieving this goal is validated through examinations and for selected functions, knowledge and skills are verified through an examination verifying special competence for activities of particular importance from the point of view of nuclear safety or radiation protection, guaranteed by the SÚJB and further formalized by issuing a licence to perform the specified work activities. The requirements for education, experience, professional, medical and mental fitness are set out for each job.

In terms of the importance of the activity performed, training and further training are divided in accordance with legislation into staff training:

- for the performance of activities specifically important to nuclear safety,
- for the performance of activities specifically important to radiation protection,
- for the performance of activities important to nuclear safety.

Training for the performance of activities specifically important to nuclear safety takes place in the following phases:

- theoretical/classroom training,
- practical training at the nuclear power plant,
- training at a full-scale simulator,
- training for a specific position.

Training and further training are conducted according to the approved training programs prepared in cooperation between the Staff Training Unit and special units of the Nuclear Energy Division.

A part of training is the training for the change of work (retraining), which is also defined by training programs.

Further training then serves to maintain and deepen specific competence of an employee as required to carry out his/her defined work. It is implemented primarily through staff training days.

In the context of training and further training, full-scale simulators of the main control room in the Dukovany NPP and the Temelín NPP are used in ČEZ, a. s., which are located on the relevant site.

The full-scale simulator is a high-fidelity copy of the operations staff workplace in the main control room, with all counters and operating panels, including all instrumentation and information system screens placed therein.

The simulator includes a separate workplace for the instructors, with the so-called instructors' station, from which the instructors check the simulator and manage the training (set-up the initial reactor condition, enter defects of the equipment and on operator's request simulate manipulations performed on the real unit by the operations staff, etc.). Communication between the training main control room staff and the instructor is via a closed circuit telephone line. The instructor also has a camera system.

Operational management training on simulators is conducted according to the timetables in line with the training programs approved by the SÚJB and the requirements of the departments of the Nuclear Energy Division.

Training instructors on the simulator at both sites are highly qualified staff of the Staff Training Unit having minimum experience as a unit shift supervisor or control room supervisor and supplementary educational knowledge. Like the operational management staff, the instructors have their own training program, the regular completion of which maintains their knowledge and skills.

Training is carried out according to the approved scenarios for the tasks included in the training course according to the approved training plan. The scenarios cover the following operating modes:

- normal operating states of a unit (start-up, shutdown and operation of the unit, systems and components at different power levels),
- elimination of error (abnormal) conditions of the unit,
- elimination of emergency (extraordinary) conditions of the unit.

Scenarios of training tasks also contain a list of used and related operating documentation, time requirements for the training, general and specific objectives of the training, description of the unit's initial state, brief theoretical description of the task, lecture scenario (description of the progress of task processed in tabular form), task analysis (instructions for training evaluation and records). Valid operating procedures are available at the simulator to solve tasks to the similar scope as in the real main control room.

When using simulators the focus of attention is on the training of main control room staff and shift and safety engineers. The simulators are also used for coordination training of selected staff of the emergency response organisation, reactor physicists and other NPP staff.

Capabilities of plant simulators used for training with regard to fidelity to the plant and scope of simulation

Full-scale simulators of the Dukovany NPP (VVER 440) and the Temelín NPP (VVER-1000/V320) are the systems developed by OSC, a. s., meeting the requirements of ANSI/ANS 3.5/1993, Nuclear Power Plant Simulators for Use in Operator Training.

They are primarily designed for the training required by legislation for control operators in an environment virtually identical to the real main control room. The properties of the simulators allow their further use as a test and analytical mean for the engineering work associated with the analysis of operating modes and conditions, validation of operating rules and procedures, verification of the suitability of I&C algorithms.

All simulations take place in real time with the possibility of making changes in the time scale of simulations through an instructor station. Technological systems and instrumentation and control systems of the unit are simulated to the full scope of the systems tested and controlled from the main control room. The simulators include models of all major control modes of the unit and also models of all other control, automatic and protection modes important to operation of the unit. Simulation fidelity meets the requirements of the above mentioned standard.

The simulators enable training of the activities performed by control operators and associated with in-service inspection and management of the equipment of NPP units performed from the main control room as part of normal operating modes and conditions. Furthermore, the simulator can simulate any type of abnormal operating modes and accident conditions in real time (including transition to severe accident conditions).

Description of the system for training of maintenance and technical support staff

ČEZ, a. s., as the licence holder, specifies the activities important to nuclear safety. These are the activities performed to meet the requirements of legislation in the field of the use of nuclear energy and ionising radiation the Czech Republic, or the requirements of internal documentation of ČEZ, a. s., to ensure nuclear safety, technical safety, radiation situation monitoring, security and radiation extraordinary event management. In addition, these are the activities whose absence, poor or unqualified performance affects the level of nuclear safety, technical safety, radiation situation monitoring, security and radiation extraordinary event management.

These activities are categorized by their impact on the level of nuclear safety. In line with this categorization, four basic types of requirements for qualification (the so-called qualification profiles) are defined, which are differentiated by the nature of the activities performed in a particular workplace. Qualification profiles define relevant training in the field of training and the length of experience.

The training of NPP staff performing the activities important to nuclear safety is organized in modules. The modules take account of the specialization by a particular profession of an employee. Training for staff performing the activities important to nuclear safety is ensured by the Staff Training Unit. Training for the performance of activities important to nuclear safety takes place in the following phases:

- theoretical/classroom training,
- practical training at the nuclear power plant,
- training for a specific position.

Training and further training are conducted according to the approved training programs prepared in cooperation between the Personnel Training Unit and special units of the Nuclear Energy Division.

Further training then serves to maintain and deepen specific competence of an employee as required to carry out his/her defined work and is implemented primarily through staff training days and training to meet other required professional qualifications.

ČEZ, a. s., as the holder of the licence for the operation of NPP, conducts training for contractor staff that is necessary for a separate entry and movement within the guarded area of the NPP and performance of the activities on NPP equipment. Training provided by ČEZ, a. s., for contractor staff include, as for licensee staff, initial training and retraining. Specific mandatory training courses for contractor staff are determined on the basis of performance of specific roles or work activities. Training courses to be completed by an employee are determined by the internal control documents of ČEZ, a. s., as the licence holder.

Contractor organizations are required to ensure the performance of their activities by qualified and competent staff and under its management system to ensure the qualifications of the person performing the processes and activities, the contractor must have established a system of staff training including qualification requirements and the way of demonstrating their fulfilment. The requirements for qualified and competent staff are based on mandatory (i.e. the requirements laid down by acts, decrees and binding documentation of ČEZ, a. s., in relation to the performance of the activities at the nuclear power plant) and non-mandatory requirements.

Improvements to training programs as a result of new insights from safety analyses, operational experience, development of training methods and practices, etc.

Evaluation of staff training including verification of knowledge is a precondition needed to establish efficiency and effectiveness of the staff training conducted under the training programs used for individual forms, stages and types of training. Results of such evaluations provide a feedback through which the contents and scope of the training programs are modified aimed at improving its effectiveness. The basic information sources used for a systematic evaluation of the training include direct verification of personnel knowledge and evaluation of the standard of training processes by trainees, guarantors and managers.

Other sources for the improvement of training programs and instruments for the training of staff include the use of operating experience from both operated nuclear power plants and international experience (WANO, IAEA, ...). Training programs for staff training are further modified on the basis of equipment modernization of the NPP, changes in operational documentation and legislation, and the use of new findings from analyses, PSA studies, etc.

Methods used to assess the sufficiency of staff at nuclear installations

NPP operator, ČEZ, a. s., has the minimum number of shift personnel specified in the licence document “Limits and Conditions for Safe Operation”. These minimum numbers are verified as part of emergency exercises and their scenarios can combine accident conditions on several units, or accidents covering the whole site, etc.

Any changes related to changes in the number of employees, or the volume of the activities affecting nuclear safety are subject to the so-called “safety assessment”. It includes impact assessment of the proposed change on safety and the possible emergence of risks. The assessment of the human factor category (the other categories are: documentation, activities, management system) includes assessment of the ability to ensure the performance of activities important to safety from the perspective of the sufficiency of persons, their substitutability, working mode (accumulation of activities, overload, stress...), the potential for human error, qualification, ability to maintain and disseminate knowledge and expertise, etc. In the case of evaluation that there could be deterioration, the change is either not implemented or such measures are taken to eliminate the negative effects.

Policy or principles governing the use of contracted personnel to support or supplement the licensee’s own staff

Some activities in the area of maintenance are performed by contractor organizations. In order to select the activities to be performed in this form, the specificity and campaign relevance of activities, sustainability and availability of know-how and economic efficiency are considered. Contractors are selected with an emphasis on availability and long-term stability of contractors in terms of their operation in the relevant market segment and from economic point of view. Long-term contractual relationships are preferred in the key areas. The reason is to support the stability of contractors and the possibility for their development.

For activities in the preparation and implementation of designs/modification, the basic principle is ensuring the activities by the licensee’s own staff. It is the specification of the technical solution, providing qualified contractors of design documentation and supervision of the implementation itself.

Where specification of the technical solution to the modification requires analyses/calculations, these are provided by qualified organizations. These are mainly the general designer, ÚJV Řež, a. s,, EGP Praha Division, universities, research and scientific organizations. Cooperation with the original contractors of systems, structures and components is also set up.

The preparation of design documentation and the implementation of modification are provided by a qualified contractor. Comments, approval of design documentation and supervision of the implementation are provided by the licensee’s staff.

Methods used to assess the qualification and training of contractor’s personnel

ČEZ, a. s., checks compliance with the competence of contractor and subcontractor staff for maintenance and investment projects. The checking of contractor staff qualification are performed by persons in specialized units under the physical inspection and oversight activities for the performance of maintenance and investment activities by checking compliance of the reality with the mandatory and non-mandatory requirements for the qualification of contractor staff under acts, decrees or with the managing documentation of ČEZ, a. s. At the same time, the audit of vendors and suppliers include verification of the system to ensure qualification of the staff performing processes and activities as required by the Atomic Act. Conclusions and findings of the inspections performed are addressed and settled in accordance with the internal documentation of ČEZ, a. s., for the management of nonconformities and contract terms and conditions with contractors.

Description of the national supply of, and demand for, experts in nuclear science and technology in the Czech Republic

Education of the experts in the field of nuclear science and technology in the Czech Republic is provided through the school system that educates these experts in secondary or higher education.

ČEZ, a. s., monitors and plans on a long-term basis staffing needs, and then uses these outputs in setting up cooperation with the respective educational institutions. This process also reflects the situation on the labour market (supply of and demand for experts in the required fields).

Cooperation between ČEZ, a. s., and educational institutions is based on long-term framework contracts or declarations of cooperation, which are concluded with 13 faculties at universities across the Czech Republic and 60 secondary schools, 30 of which are directly in the regions of the two nuclear power plants in operation.

An important part of the activities intended to promote the education of future nuclear experts are the specific recruitment programs “Nuclear Graduation” and “Summer University” organized in both nuclear power plants regularly. Both programs last several days (3 days and 12 days, respectively) and are based on a combination of lectures, discussions with NPP experts and related practical inspections of NPP technology. The participants in the “Nuclear Graduation” programs are the selected pupils from partner schools; the participants in the “Summer University” programs are mostly the interested students of partner faculties. The “Summer University” program is a source for acquiring scholars who are being prepared for key positions in a nuclear power plant.

Specific one-day events are organized at both nuclear power plants with a narrow specialization (e.g. radiation protectionor, non-destructive testing etc.). Other similar events are then implemented at partner schools. All this is performed to ensure staff in specific areas of activities and address the age variation (currently primarily at the Dukovany Nuclear Power Plant).

Another form of preparing and acquiring the necessary experts is to influence the offer of study programs at schools or, in cooperation with schools, to adjust their content so as to match the qualification requirements placed upon the experts in nuclear field. An example of such cooperation is the creation of the “Energy” field of study in cooperation with the Vysočina Region and the Secondary Technical School, Třebíč. The curricula created for this field of study in cooperation with the experts from the Dukovany Nuclear Power Plant reflect the specifics of preparation for the selected positions at a nuclear power plant.

In addition to standard instruments such as newspaper advertisements, modern communication channels, in particular social networks, are used to address experts on the labour market. The activities implemented in the context of addressing nuclear experts are positively assessed. ČEZ, a. s., is ranked in leading positions in the surveys among pupils and students about the most desirable employer. Also the feedback from the labour market obtained in the context of annual survey of perception of ČEZ, a. s., as a prospective and responsible employer, is highly positive.

Methods used for the analysis of competence, availability and sufficiency of additional staff required for severe accident management, including contracted personnel or personnel from other nuclear installations

The setting (analysis) of competencies of staff responsible for severe accident management is defined by internal documentation of the licence holder. The verification of required competencies, availability and sufficiency of staff takes the form of emergency exercises and drills, from which the final assessment is prepared that includes the identified deficiencies and proposals for their elimination. In the event that the deficiency related to the competence, availability and sufficiency of staff is identified, the licence holder has the procedures set up to address the deficiency. Beyond emergency exercises, the availability of staff is verified by periodic inspections of the availability of the members of a standby emergency response organization.

The results of the availability of the members of a standby emergency response organization are one of the Key Performance Indicators of the process of radiation extraordinary event management. The availability and sufficiency of staff are subject of the PSR. The competence, availability and sufficiency of staff for the field of emergency preparedness are addressed in Chapter 16.

Role of the regulatory body in the supervision of human resources

The SÚJB leads and coordinates examining boards, which verify special competence of personnel conducting activities particularly important to nuclear safety and radiation protection. It issues authorizations to such persons to conduct the activities. The SÚJB has the power to withdraw the authorization in special cases. The SÚJB examines the staff training system within its controls. The SÚJB also controls the readiness of personnel for the restart of the nuclear unit after refuelling.

The issues of the sufficiency of human resources are included in the SÚJB inspections in the area of the Integrated Management System. This area also forms a natural part of other types of inspections, which may give rise to other activities in this area.

Statement on the implementation of the obligations concerning Article 11 of the Convention

The provision of financial and human resources for nuclear safety assurance in the Czech Republic is in compliance with the requirements established in Article 11 of the Convention.

12. HUMAN FACTORS

Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

12.1 Methods for prevention, determination and correction of human errors

Legislative requirements

The Atomic Act establishes in Section 5(5) b), as one of the general obligations of a licensee, the obligation to:

“Continuously and comprehensively evaluate compliance with the principles of the peaceful uses of nuclear energy and ionising radiation from the perspective of the present level of science and technology and ensure that the results of the evaluation are applied in practice.”

Furthermore, Section 5(7) states: “Anyone who uses nuclear energy shall collect, sort, analyse and document experience and security-relevant information by a feedback system in ensuring nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security and take into account the importance of the interaction between personnel, technology and organisational arrangements.”

The investigation of human impact on operation safety is one of the basic components of these processes.

Decree No. 329/2017 Coll., further specifies the requirements in Section 4(1) that nuclear installation design, including nuclear installation modification design, shall fulfil the following safety objectives:

Pursuant to letter e), take into account human factor impact on the function of the nuclear installation and each of its systems, structures and components relevant to nuclear safety, radiation protection, radiation situation monitoring, radiation extraordinary event management and security, and the influence of the nuclear installation’s properties on human performance.

Furthermore, the obligation in letter f) to introduce processes ensuring compliance of the nuclear installation design throughout the life cycle of the nuclear installation with the current state of:

1. experience from the operation of nuclear installations;
2. international experience;
3. the nuclear installation with regard to ageing of its systems, structures and components, and
4. science and technology.

Therefore, human factors are considered in both the nuclear power plant design and the operation and processes of subsequent modifications (see Chapter 18.3).

Methods for analysing, preventing, detecting, and correcting human errors in the operation and maintenance of nuclear installations

Instruments used for the prevention and correction of human errors are divided into three sets. Instruments for leaders and organization; instruments for engineers and specialists; instruments for executive staff and working teams. The most frequently used instruments for executive staff (maintenance teams) include: Task Preview, Job-Site Review, Questioning Attitude, 4Z Self-Checking, Procedure Use and Adherence, and Three-Way Communication. The walkdown system is used for correcting human error. The managers use the managerial walkdowns, thus declaring their interests in the activities performed. The leaders use the walkdown inspections as one of the methods to prevent human error. The most frequently used instruments to prevent human errors used by leaders include: Observation Program, Coaching and Correcting, Identifying Focus Areas, and Positive Reinforcement.

The monitoring of the Analysis of Human Impact on the Occurrence and Development of Operational Events is the responsibility of the Units of Operating Experience Groups of the Dukovany NPP and Temelín NPP Operating Experience. Feedbacks of the Dukovany NPP and the Temelín NPP take place in accordance with the respective common control documentation applicable in both NPPs. The human performance is understood as a significant safety element and permanent attention is paid to its possible failure. The purpose of human factor evaluation is to assess the level of various human behaviour impacts on performance of activities related to technological process as well as on safe operation of the nuclear power plant. The importance of the human performance as a significant matter in safety is taken into account in the methodology of the evaluation of operational events and their importance according to the INES scale.

The results of periodic assessment of operational events in individual nuclear power plants confirm that a significant proportion of the operational events is caused by one of the forms of human failure. It is either a direct human failure in performing a particular activity or a human failure in other areas (documentation, design, etc.).

Within execution of the analyses of operational events at which investigation process the human error impact during performance and/or inspection of activities was identified, the human performance analysis is executed. The procedure of human impact analysis is executed according to methodology Human Performance Evaluation System (HPES). The approach to execution of human impact analysis is based on the principle Blame – Tolerant Policy, on the contrary, it is necessary to create the atmosphere for open communication for final investigation of the causes of inappropriate behaviour of the staff. The evaluation of human contribution is executed for improvement of human behaviour (performance) in relation to gaining of own experience. Its purpose is not to punish the staff for unwilling mistakes; detected causes of inappropriate behaviour of the staff are understood as the benefit for further improvement of NPP operation reliability and safety. The staff involved in detection of the causes of human errors are trained in using methodology HPES. The human performance impact is monitored within all units of NPP and contractor organizations.

The causes of human failure are assessed and confirmed by the Correction and Prevention Commission for event investigation in the nuclear power plant (each NPP has its own Failure Commission). Based on the respective analysis corrective measures are imposed aimed at effectively ensuring that the same deficiencies in human behaviour do not repeat thus eliminating repetitive events.

One of the means for failures prevention are training days regularly organized for selected categories of NPP shift and non-shift personnel. These training days include information on selected operational events, based on specialization of the trained personnel and with regard to the cases of human errors.

Obligatory psychological examination is applied in a graded approach for selection of personnel to minimize risk of failures caused by carelessness or negligence.

To minimize the human error impact in the course of performing activities the NPP has been continuously developing a system of operating procedures to guide each operator and warn about potential risks, while providing unambiguous description of activities. Selected manipulations are described in the form of check-lists. When setting the safety systems into the emergency mode the method of independent inspection is applied.

The “Nuclear Professional” program takes place in the Nuclear Energy Division, which integrates nuclear activities. This program is a unifying element of both operated nuclear power plants in the area of human performance. Its primary mission is to develop a safety culture, while implying the introduction and proper use of the instruments for human error prevention. The “Nuclear Professional” program is centrally managed by a division team, followed by implementation site teams (Dukovany NPP and Temelín NPP).

Arrangements for the feedback of operating experience in relation to human factors and organizational issues

The Atomic Act establishes in Section 30(7), as one of the general obligations of licensees, as follows:

"The persons referred to in Section 29(1) shall introduce the management system in a manner ensuring that through this system are permanently developed and regularly evaluated characteristics and attitudes of persons performing activities related to the use of nuclear energy and activities in exposure situations and of their personnel, which ensure that nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security are approached with a seriousness corresponding to their importance (hereinafter "safety culture").".

This requirement of the Atomic Act is further specified in Decree No. 408/2016 Coll., on management system requirements, where Section 13 imposes an obligation upon licence holders to develop and assess a safety culture, see Annex 4.

Section 5(2) c) and Section 5(2) d) of Decree No. 21/2017 Coll., on ensuring nuclear safety of a nuclear installation impose an obligation upon operators to assess the activities of workers, using the methods for impact assessment of human and organizational factors, and to assess the impact of safety culture on operational event, respectively. These requirements are fulfilled by means of a feedback system (see Section 19.7).

Human failure causes, including evaluation of trends of human factor impact, are in both NPPs regularly evaluated in the annual reports on operational events, together with factors contributing to human failure. For the purposes of the continued assessment of human performance and its comparison over time, a set of human performance indicators is monitored.

Self-assessment of managerial and organizational changes

Organizational changes in licence holder structure are categorized by their impact on nuclear safety, radiation protection, physical protection, emergency preparedness, and technical safety in a graded approach.

The licence holder shall carry out self-assessment. All the changes in organizational structure and the way of changing it in a graded approach are assessed in terms of risks to important processes. The risks identified are managed in the change process. Depending on the degree of influence of the change, these are authorized by, or only notified to the SÚJB. The success of the organizational change made shall be assessed within an adequate interval of time.

The annual self-assessment of safety culture takes place at three organizational levels: Nuclear Energy Division, Dukovany NPP and Temelín NPP. This assessment is based on the WANO standards, where the safety culture is divided into three categories: individual liability, management liability and organization (system) liability. The self-assessment includes opinions of both own staff and staff of major contractors. In addition, operating experience feedback (events, nonconformities), in particular in the field of human performance, and independent assessment by the Inspectorate of ČEZ, a. s., and the SÚJB. Based on the findings of self-assessment, the Action Plans for Safety Culture Development are developed and subsequently evaluated on an annual basis (see Annex 5).

12.2 Regulatory activities of the SÚJB in human and organizational factors

The SÚJB systematically monitors the impact of human and organization factors on the operational safety. This is carried out by the Correction and Prevention Commission as part of regular discussion of the analyses mentioned above. In this respect, the SÚJB particularly reviews whether the events with contribution of human and organizational erroneous actions were investigated in sufficient detail, whether corrective actions address determined causes so that recurrence of the events is prevented and whether such corrective actions are implemented in the proper and timely manner. In particular cases, a special inspection related directly to a certain event with significant contribution of human and organizational factors can be carried out. The SÚJB further evaluates separate reports sent on an annual basis, which include the trend analysis of events with contribution of human and organizational factors by selected aspects. The field of human factors is also a separately evaluated element within PSR.

A system of verification of special professional capability for selected personnel of nuclear installations is instrumental in the prevention of potential failure. In accordance with the Atomic Act (see SÚJB competence in Chapter 8.1.3) the SÚJB shall establish for this purpose an examining board and identifies activities with immediate impact on nuclear safety. Verification is carried out in form of an exam in front of the examining board.

This exam consists of examination at a simulator, theoretical written and oral part, and a practical part, including examination at a simulator. The examining board may decide to skip the practical part or to allow the so-called integrated test (oral examination is directly linked to examination at a simulator) in the case of authorization renewal. Should an employee fail in the exam, he/she can repeat it. Under the implementing regulation an individual who has successfully passed the exam in front of the examining board is granted an authorization for activities specifically important to nuclear safety by the SÚJB for a period of 2 to 8 years, depending on the results and experience.

Statement on the implementation of the obligations concerning Article 12 of the Convention

The requirements under Article 12 of the Convention, on evaluation of possible human factors impact on operational safety over the whole service life of nuclear installations, are complied with in the Czech Republic.

13. QUALITY ASSURANCE

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programs are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

13.1 Overview of the arrangements and legislative requirements for management systems, management system programs including quality assurance by holders of processes and activities and their outputs by licence holders and their contractors.

Sections 29 and 30 of the Atomic Act set out the requirements to introduce and maintain a management system for anyone who uses nuclear energy or performs activities in exposure situations, which are regulated by the implementing regulation.

Pursuant to the provisions of Section 29(1):

“With the aim of ensuring and increasing the level of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security, a management system shall be introduced and maintained by...”

The implementing regulation is Decree No. 408/2016 Coll., which regulates in detail:

- requirements for the implementation, maintenance and improvement of the management system,
- the content of management system documentation and how it is kept,
- rules for conducting and managing of the processes and activities,
- rules for conducting and managing of the special processes,
- management system planning and the scope and method of its documentation,
- procedures for implementing changes to the management system,
- rules for assessing the efficiency of the management system, including the processes and activities and changes thereto,
- non-conformity management procedures,
- how the appropriate qualifications of personnel conducting processes and activities are ensured,
- the scope of and method for ensuring permanent development and regular evaluation of the safety culture and
- requirements for the management system program content.

Pursuant to the provisions of Section 30(2):

“Persons referred to in Section 29(1) may only be supplied products or services by a person who has introduced and maintains a management system in compliance with the requirements under this Act or by other means ensuring the quality of processes and activities and their outputs comparable with the requirements under this Act.”.

13.2 Status with regard to the implementation of integrated management systems at nuclear installations

Quality assurance strategy was already a part of the first concept of business activity approved by General meeting of the ČEZ, a. s., in July 1995 that enabled to direct business activities of the ČEZ, a. s., and to create the conditions for sustainable and successful development of the ČEZ, a. s.

The management system is implemented and maintained to ensure the processes and activities important to nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security in a controlled and organized manner, fully within the limits of the Atomic Act and its implementing regulations, including the requirements of Decree No. 408/2016 Coll., on management system requirements, which are applied in a graded approach according to the importance of individual processes and items to nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security.

The management system is in compliance not only with legislative requirements (Decree No. 408/2016 Coll.) but also it is harmonized both with generally recognized criteria standards ISO (ISO 14001, ISO 27001 and ISO 50001, and program “Safe Enterprise”) as well as specific recommendations of IAEA and WENRA. In the case of laboratories and inspection body, their partial management systems are implemented according to the specific requirements of ISO/IEC 17025 and ISO/IEC 17020.

ČEZ, a. s., is the signatory to the Quality Charter of the Czech Republic. The fulfilment of the commitments under the Charter is supported by ČEZ, a. s., through activities covered by the Quality Council.

Based on the requirements of Decree No. 408/2016 Coll., and the SÚJB Safety Guide BN-JB-1.1, the Policy of Safety in Nuclear Activities was declared by the Director of Nuclear Energy Division in 2022.

The top management of ČEZ, a. s., is committed to protecting people and the environment from the effects of ionising radiation through continual improvement in the quality of management and the level of nuclear safety, radiation protection, technical safety, radiation situation monitoring and extraordinary event management.

To ensure the safe operation of nuclear installations of ČEZ, a. s., and the continuous assurance and continuous improvement of the quality of process and activity management, measures are announced in the Policy of Safety in Nuclear Activities:

1. We maintain, assess and improve the management system.
2. We determine the effective way of management in individual levels of management.
3. We ensure compliance of the performed activities with the legal requirements.
4. We implement measures to ensure and increase the level of safe operation of nuclear power plants.
5. We maintain and further develop the ability to lead employees and qualify employees.
6. We evaluate and develop the nuclear safety culture.

The ČEZ, a. s., declares compliance with and improvement of the level of safety, environmental protection and quality through the certificates obtained and regularly renewed. All nuclear, conventional and hydroelectric power plants are long-term holders of the ISO 14001 certificate and Safe Enterprise certificate. In 2021, the Nuclear Energy Division obtained the certificate of the Information Security Management System according to ISO/IEC 27001.

In the course of 2021, ČEZ, a. s., introduced a Business Continuity Management System according to ISO 22301. Both calibration laboratories of ČEZ, a. s., are accredited by a national accreditation body according to ISO/IEC 17025. The calibration laboratory for metrology of ionising radiation is also authorised by the Czech Metrology Institute as an authorized metrology centre for verification of working controlled measuring instruments. Selected testing laboratories are accredited by a national accreditation body according to ISO/IEC 17025, or have a laboratory competence assessed by the Centre for the Assessment of Laboratories (ASLAB). ČEZ, a. s., has two accredited inspection bodies for technical equipment according to the requirements of ČSN EN ISO/IEC 17020 for the purpose of demonstrating the technical safety of technical equipment, namely one inspection body in the Renewable and Conventional Energy Division and one in the Nuclear Energy Division.

To introduce, assess and continuously improve processes and activities, the Management System Unit, directly reporting to the Managing Director, has been established in ČEZ, a. s., which provides the strategic management with efficient feedback for the management system. Feedback over compliance with safety requirements for strategic management is provided.

13.3 Main elements of a typical management system program covering all aspects of safety throughout the lifetime of the nuclear installation, including safety related activities by contractors

To describe the management system of the licensed activities specified in the Atomic Act, the "Management System Program" document applies, which is also one of the conditions for issuing a licence by the SÚJB to perform the licensed activities.

According to the requirement of the Atomic Act, the Management System Program is developed for licensed activities according to Section 9(1) a) to h), Section 9(2) a) to d), f), Section 9(3) a), b), and Section 9(4) a) to c).

The Management System Programs fall under the category of the documentation not approved by the SÚJB whose contents (i.e. the required particulars including specification of the activities performed by contractors) are set out in Section 16 of Decree No. 408/2016 Coll.

The purpose of the Management System Program as the so-called licensing document listed in Annex 1 to the Atomic Act is to provide information and documents on compliance with the requirements for the introduction of the management system pursuant to Section 29 and Section 30 of the Atomic Act. From the point of view of the management system, it specifies, among other things, the requirements, whose fulfilment is a condition for the feasibility of the licensed activity within the introduced management system of the organisation of the licence holder.

The development, review, recommendation, approval, registration, archiving including revisions of the Management System Program documents in ČEZ, a. s., follow the methodology "Creation of the Management System Program", except for the Management System Program for licensed activities in accordance with the Atomic Act, Section 9(1) f) the operation of a nuclear installation, Section 9(2) b) the operation of category III workplace or category IV workplace, and Section 9(3) a) radioactive waste management. The document "Operational Management System Program" also describes the requirements related to its processing and handling, including the principles for its implementation and revisions. The scope of selected requirements and the method of ensuring their fulfilment for drawing up the management system program for the operation of a nuclear installation with a nuclear reactor is based on the SÚJB Safety Guide – BN-JB-1.1, Management System.

Pursuant to Section 30(1) of the Atomic Act, the licence holder shall lay down the requirements for the selection and qualifications of suppliers of products or services and manage and monitor the supplies of products or services.

Pursuant to Section 30(2) of the Atomic Act, the supplier of a product or service may only be supplied products or services by a person who has introduced and maintains a management system in compliance with the requirements under this Act or by other means ensuring the quality of processes and activities and their outputs comparable with the requirements under this Act.

13.4 Audit programs of the licence holders

The Internal Audit function is introduced within the ČEZ, a. s. The Internal Audit Unit is an independent unit, i.e. it reports to the Board of Directors (it also functionally reports to the Audit Committee) and its activities are guided by internationally recognized standards (International Framework for Professional Practice of Internal Audit issued by The Institute of Internal Auditors). The Internal Audit operates also in the context of nuclear activities. The selected qualified auditors are appointed in the Internal Audit Unit for these audit work.

The Internal Audit of ČEZ, a. s., provides the management and the bodies of the company with assurance that the internal management and control system is functional and all significant risks are adequately managed. This contributes to achieving the goals of the ČEZ, a. s., and initiates improvement of the activities and reduction of business risks.

Its work is carried out on the basis of the annual internal audit plan, which is based on a medium-term strategy of the Internal Audit, the concept of which was approved by the Board of Directors of ČEZ, a. s. Planning is based on a risk assessment of the individual process areas. Risk assessors are the members of the Board of Directors of ČEZ, a. s., members of the Risk Management Committee, employees of the Risk Management Unit and Internal Audit Unit. The approved strategy of the Internal Audit requires conducting audits for the group of the processes at highest risk and is regularly assessed in its entirety over three consecutive years.

Another source to develop the annual activity plan of the Internal Audit Unit includes the proposals of executive staff of the ČEZ, a. s., and employees of the Internal Audit Unit. These employees formulate the proposals for audits in the field of nuclear activities or activities important to nuclear safety primarily on the basis of the following sources:

- report on Management System Review including proposals for improvement,
- outputs of the Committee on the Facility Safety,
- report on the oversight of nuclear power plant safety,
- information from risk management,
- information from the non-conformity management system,
- findings of the international missions and inspections (WANO, OSART) or the SÚJB inspections.

The final report of the audit is submitted to the guarantor for audit (usually a guarantor for the audited process/area) and the contracting authority for audit (usually the director of the relevant division). The report contains a set of the corrective measures defined by the responsible executive staff of the ČEZ, a. s. The fulfilment of corrective measures is continuously verified by the Internal Audit Unit. To this purpose, a monitoring system including appropriate IT support is introduced.

The results of audits and fulfilment of the corrective actions are regularly (usually quarterly) submitted to the Board of Directors and the Audit Committee of ČEZ, a. s.

13.5 Audits of vendors and suppliers and evaluation of suppliers

For safety-relevant items, execution of the outsourced process is subject to the supervision by a licensee. Licensee's supervision of outsourced processes or their parts (activities) is documented in the form of the audits of vendors and suppliers and evaluation of the activities carried out by suppliers:

a) Supplier audits

The objective of the audits of vendors and suppliers is to systematically verify professional competence and qualification of existing and potential contractors for safety significant items for the area of NPP, the so-called “selected equipment” and the services provided on selected equipment, in the fulfilment of management system requirements under the Atomic Act, Decree No. 408/2016 Coll., in connection with the management system and also Decree No. 358/2016 Coll., as well as specific requirements of other legislation, harmonized technical standards and technical regulations, and other requirements of ČEZ, a. s.

The outcome of the suppliers audit is the issuance of time limited Supplier Authorization for qualified supplies of products and services including selected equipment for NPP within the Nuclear Energy Division.

b) Evaluation of suppliers

The objective of the evaluation of suppliers is to continuously monitor and evaluate the stability and quality of the products and services supplied by already qualified suppliers of selected equipment through a system of feedback from special units within the specified areas of evaluation according to the predefined parameters and criteria.

c) Spot checks during work carried out by suppliers

In addition to customer audits and evaluation of suppliers, suppliers are subject to checks in the framework of particular actions by responsible project worker, in the preparation of project implementation and the implementation itself. Other inspection activities aimed at verifying safety in all areas, system functionality, state of equipment and premises, safe behaviour of personnel and contractors, and compliance with safety culture at the Dukovany NPP and the Temelín NPP are the so-called “joint inspections”. During work carried out by suppliers, checks of technical surveillance also take place for activities provided by suppliers for maintenance and repairs of equipment of nuclear power plants. There are also separate inspections from the point of view of occupational safety and health (OSH), fire protection, EMS, etc.

Specific supervision of suppliers or supply chains, in particular for items with regard to their importance to safety, is carried out by special units of ČEZ, a. s., (Quality Management, Maintenance, Procurement, Safety, Asset Management, Staff Training Centre, Engineering, and, where appropriate, others) to the extent of their competence and defined activities in the framework of the relevant internal legislation in the area of management in question (in particular certification of the quality system, EMS, OHS, training, customer checks, initial inspections, inspections of nuclear safety, radiation protection, technical safety, inspections of radiation extraordinary event management, and security, applicant and manager during implementation of activities, acquisition of information on technical and economic background of supply chains, links and their ability to meet requirements under contract).

13.6 Current practices applied by the regulatory body in the area of quality assurance

In accordance with Section 200 of the Atomic Act, the SÚJB inspects the licence holder for compliance therewith including regulations issued for its implementation, fulfilment of the decisions issued under this Act and the requirements set out in the management system documentation for the extent of quality assurance of their outputs and fulfilment of the acceptance criteria of these outputs. Where necessary, this activity is extended also to the suppliers of products and services. The inspection activities are being directed to both management system and quality assurance and technical safety of specific selected equipment.The SÚJB unit primarily performing this activity is the Nuclear Installation Monitoring Section (see Organizational Chart of the SÚJB, Fig. 8-1).

In accordance with Section 24 of the Atomic Act, the SÚJB shall assess, for nuclear installations, the Management System Programs and its amendments that are part of the documentation for the licensed activity:

- siting,
- construction,
- individual phases of commissioning including physical and first power start-up,
- operation,
- modification affecting nuclear safety, technical safety and physical protection, and
- individual phases of decommissioning.

In the field of performance of the activities in exposure situations, the Management System Programs shall be assessed for:

- construction of category IV workplace,
- operation of category III and IV workplaces,
- reconstruction or other modifications affecting radiation protection, radiation situation monitoring and radiation extraordinary event management in a category III and IV workplaces,
- individual phases of decommissioning of a category III and IV workplaces, and
- import of ionising radiation sources for their own use or import of laser generator.

In the field of radioactive waste management, the Management System Programs shall be assessed for:

- activities in the field of radioactive waste management, except for collection, sorting and storage of radioactive waste directly at the producer of radioactive waste, and
- closure of a radioactive waste disposal facility.

In the field of transport of radioactive and fissile material, the Management System Programs shall be assessed for:

- transport of fissile material, and
- transport of radioactive material.

The Management System Programs and their amendments assessed by the SÚJB are an important part of the documentation for the licensed activity and a prerequisite for issuing a licence for the activities specified in Section 9 of the Atomic Act.

The SÚJB also approves the List of Selected Systems, Structures and Components, a document listing items important from the viewpoint of nuclear safety, included in three safety classes in accordance with the criteria set out in Annex 1 to Decree No. 329/2017 Coll., which are in accordance with IAEA requirements and criteria.

To issue a licence for siting of a nuclear installation the SÚJB shall consider in terms of quality assurance the following:

- Initial Safety Analysis Report, in particular the evaluation of quality assurance in the selection of the site,
- description of the method of quality assurance for construction project implementation, and
- principles of quality assurance for the following phases of the nuclear installation’s life cycle.

To issue a licence for the construction of a nuclear installation the SÚJB shall assess in terms of quality assurance the following:

- Preliminary Safety Analysis Report,
- evaluation of quality assurance during preparation for construction,
- description of the method of quality assurance for construction project implementation, and
- principles of quality assurance for the phases of the nuclear installation's life cycle following construction.

For a licence for the activity, which is the first physical start-up of a nuclear installation, the SÚJB shall assess in terms of quality assurance:

- final safety analysis report for the first physical start-up of a nuclear installation, and
- quality assessment of selected equipment.

At the same time, the SÚJB shall assess all the documents set for the licensed activity in accordance with Annex 1 to the Atomic Act.

Statement on the implementation of the obligations concerning Article 13 of the Convention

The current legislation of the Czech Republic and its practical application guarantee that quality assurance programs are developed and implemented, making sure that all specified requirements for all safety related activities are applied in a controlled manner, updated and will be fulfilled over the whole period of the service life of a nuclear installation. The requirements specified in Article 13 of the Convention are fully complied with.

14. ASSESSMENT AND VERIFICATION OF SAFETY

Each Contracting Party shall take appropriate steps to ensure that:

(i) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;

(ii) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

14.1 Assessment of safety

14.1.1 Approval process and requirements of the regulatory body for comprehensive and systematic safety assessment

Pursuant to the provisions of Section 48 of the Atomic Act, the level of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security shall be regularly, systematically, comprehensively and verifiably assessed by the licence holder during the life cycle of a nuclear installation and the results of safety assessment shall be applied in practice. The verification/assessment shall be documented. The content of the documentation for the activity to be licensed is specified in Annex 1 to the Atomic Act.

Furthermore, pursuant to Section 49 “General obligations of holders of a licence for an activity related to the use of nuclear energy”, the licence holder shall conduct safety assessment. Based on the safety assessment, the licence holder shall constantly increase the level of nuclear safety as far as reasonably practicable; and also shall ensure that the safety assessment is verified by persons who did not directly participate in the safety assessment, in all cases when the safety assessment concerned facts that were of relevance to ensuring nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security of a nuclear installation.

The licence holder shall, from the beginning of construction to decommissioning of the nuclear installation, continuously monitor the state of the nuclear installation and its systems, structures and components in terms of the implementation of the controlled ageing process in accordance with the ageing management program. This is given in the same Section 49 of Atomic Act.

Safety assessment is, in compliance with the Atomic Act, reviewed by the SÚJB, both analytically and within its inspection activities. Details concerning the safety related documentation preceding construction of a nuclear installation, preceding its commissioning and during its operation, are described in Chapters 17, 18, and 19.

The requirements given in the Atomic Act and in consequential decrees and the SÚJB Safety Guides establish basic criteria for nuclear safety assessment of a nuclear installation during different stages of its life cycle.

The following are particularly concerned:

- ***Decree No. 358/2016 Coll.,*** on requirements for assurance of quality and technical safety and assessment and verification of conformity of selected equipment.
- ***Decree No. 378/2016 Coll.,*** on siting of a nuclear installation.
- ***Decree No. 408/2016 Coll.***, on management system requirements.
- ***Decree No. 21/2017 Coll.,*** on ensuring nuclear safety of a nuclear installation.

- ***Decree No. 162/2017 Coll.,*** on requirements for safety assessment according to the Atomic Act.
- ***Decree No. 329/2017 Coll.,*** on the requirements for nuclear installation design.

The requirements referred to in the SÚJB decrees are specified in guides issued by the SÚJB. The guides are based on international practice, in particular IAEA Safety Guides as well as WENRA requirements.

This includes, for example:

- BN-JB-1.1, Management System,
- BN-JB-1.2, Professional Education and Training of Personnel at Nuclear Installations,
- BN-JB-1.3, Safety Analysis Report Content,
- BN-JB-1.4, Ageing Management for Nuclear Power Plants;
- BN-JB-1.5, Defence in Depth,
- BN-JB-2.2, Deterministic Analyses of Design Extension Conditions without Severe Fuel Failure (DEC A),
- BN-JB-2.3, Deterministic Safety Analyses of Postulated DEC B Initiating Events and Scenarios of the DEC B category,
- BN-JB-2.4, Quality Assurance in the Development and Use of Computer Codes for Safety Assessment,
- BN-JB-2.5, Probabilistic Safety Assessment,
- BN-JB-2.6, Use of PSA in Integrated Risk-Informed Decision-Making in the Assessment of Modifications in Nuclear Installations,
- BN-JB-2.7, Use of PSA in Risk-Oriented Decision-Making within the Assessment of Permanent and Temporary Changes of the Limits and Conditions (L&C) and Assessment of the L&C Adequacy,
- BN-JB-2.8, Selection of Relevant SSCs Using PSA,
- BN-JB-2.9, Periodic Safety Review,
- BN-JB-2.10, Deterministic Safety Analyses of Events of Abnormal Operation and Design Basis Accidents,
- BN-JB-3.2, Design of the Pressurized Water Reactor Core,
- BN-JB-3.3, Categorisation of Safety Functions and Clasification of Systems, Structures and Components into Safety Classes,
- BN-JB-3.5, Protection against Internal Fire,
- BN-JB-4.1, Nuclear Installation Siting – Assessment of Natural Hazard and Phenomena,
- BN-JB-4.2, Nuclear Installation Siting – Assessment of Human Induced Hazards,
- BN-JB-5.2, Making Use of Operating Experience at Nuclear Installations,
- BN-JB-5.3, Maintenance, In-service Inspections and Performance Tests,
- BN-JB-5.4, Making Modifications on Nuclear Installations,
- BN-JB-5.6, Flow Accelerated Corrosion (FAC) Ageing Management Program for WWER Type Nuclear Power Plants,
- BN-JB-6.1, Technical Safety.

The IAEA recommendations applied include in particular the documents of the level of SF-1, GSR, SSG and related guides and technical documentation. They are used as a guide for the interpretation of the requirements in the higher level documents. The WENRA documents applied include in particular the WENRA Safety Reference Levels for Existing Reactors.

By including the best international practice, in particular IAEA requirements in the Safety Guides, the objectives, formulated in the Principle 3 of VDNS, are fulfilled, as described in Chapters 6, 7, and 18.

Safety assessment and verification, as described hereinafter, confirm compliance with the safety requirements defined in the Principle 2 of VDNS. This Principle requires a periodic and regular safety assessment throughout the life cycle of a nuclear installation. Deterministic and probabilistic safety assessments (see Chapter 14.1.2) are complemented and confirmed by continued verification of safety through inspections, tests and systematic supervision both through internal procedures on the premises of an operator of a nuclear installation and by regulatory body (see Chapter 14.2).

Practical application of the requirement to perform systematic and comprehensive assessment of a nuclear installation for checking on its constant compliance with its design, safety requirements defined in the national legislation and with Limits and Conditions is described below. These include in particular:

- deterministic safety assessment,
- probabilistic safety assessment,
- periodic safety review,
- continuous safety review,
- special safety review (in case of modification at a nuclear installation, in case of a suspicion of reduced level of nuclear safety, etc.).

14.1.2 Safety assessments within the licensing process and other phases of life cycle

Continuous monitoring of operational safety of the Dukovany NPP and Temelín NPP units performed by the licensee focuses in particular on the assessment of compliance with the Limits and Conditions.

This activity is done both by personnel of the units responsible for performance of such activities (self-assessment process) and independently by specialists of a specific safety unit (as part of licence holder) responsible for nuclear safety overview. Personnel of the safety unit are also responsible for independent verification of the fulfilment of test completion criteria during operation and after maintenance, before equipment after maintenance is ready for operation.

During outages, additional requirements are checked, dealing with the work procedures and manipulations on technological equipment. The inspections are conducted by staff of the relevant unit responsible for realization of both NPPs and the safety unit personnel as well as by executive staff of the units carrying out work during the outages of reactor units (Management System Review).

The information on safety assurance is presented both in the text part of monthly and annual safety reports of NPP and graphically in the form of indicators. The latter form uses indicators containing information about safety systems reliability, conditions of certain equipment in general, environmental impact of NPPs operation and about compliance with the established principles for the given area (fire protection, industrial safety).

The Safety Monitor, version 4.2, is used to monitor the operational risk level of all units of ČEZ NPPs depending on current equipment configuration. This tool together with the models of respective units is used at Temelín NPP and Dukovany NPP. Cumulative and instantaneous risk may be evaluated or pre-calculated by using this tool depending on currently valid or intended NPP technology in given instant of time or during given period of time.

This tool is also used to evaluate the time schedules of all outages for risk level optimisation at least two months prior to planned outage, and to evaluate real or intended changes in time schedule during outage. Original and actual course of the risk are analysed after outage completion in order to optimize maintenance activities in terms of unit configuration during outage.

The information describing the level of nuclear and technical safety, radiation protection, fire protection, and industrial safety is evaluated periodically (weekly reports on the nuclear safety status and monthly and annual reports on the nuclear safety status in the Dukovany NPP and Temelín NPP) and discussed on the individual management levels within ČEZ, a. s. The unavailability of the individual components with impact on nuclear safety is monitored monthly. Results of this monitoring are also submitted in the form of operational indicators into the power plants information system network.

Impact of individual component unavailability on nuclear safety is assessed using the immediate value of the Core Damage Frequency as well as a cumulative risk value of the latter is the Core Damage Frequency multiplied by the duration of the component unavailability.

Deterministic safety assessment (Final Safety Analysis Report)

The demonstration of safety of nuclear power plant units is in compliance with the old and the current legislation documented in the Final Safety Analysis Reports (FSAR) for Dukovany NPP and Temelín NPP. The summary document on the results of assessment of preparedness of the nuclear installation and its personnel for further operation after refuelling outage includes a list of changes in the Final Safety Analysis Report made during the last campaign.

The Final Safety Analysis Reports for Dukovany NPP and Temelín NPP are updated regularly (the texts of updated Final Safety Analysis Reports for the previous year are submitted to the SÚJB once a year) in order to demonstrate that the levels of safety of the Dukovany NPP and the Temelín NPP are in accordance with the current level of science and technology and with good practice, while using experience from previous operation.

The Final Safety Analysis Reports for Dukovany NPP and Temelín NPP are prepared to meet the requirements of Annex 4 to Decree No. 329/2017 Coll., using the concept based on the guide US NRC RG 1.70, which is elaborated in detail in the SÚJB Safety Guide BN-JB-1.3, Safety Analysis Report Content.

Modifications in the NPP’s project must be, depending on the nature of modification (i.e. according to the results of their impact assessment on nuclear safety, technical safety or security), notified to or approved by the SÚJB before their implementation. Before implementation of modifications affecting nuclear safety, technical safety or security of a nuclear installation, the validity of the safety assessment referred to in the Final Safety Analysis Report must be reviewed. The responsibilities of particular units of power plant in evaluation of impacts of the change upon particular processes are determined in the relevant internal management documentation.

Periodic Safety Review

At Dukovany NPP and Temelín NPP comprehensive safety level assessments are executed at regular ten-year intervals using an internationally broadly applied tool, the so-called “Periodic Safety Review” (PSR). These reviews are conducted fully in compliance with the requirements of Czech legislation and recommendations of IAEA and WENRA. The PSR evaluates a total of fourteen areas – Design of the Power Plant; Actual Status of Systems, Structures and Components; Equipment Qualification for Ambient Conditions; Ageing; Deterministic Safety Analyses; Probabilistic Safety Assessments; Risk Analyses; Operational Safety; Feedback from the Operation of Other Nuclear Installations, and Science and Research Results; Organization; Management System and Safety Culture; Procedures; Human Factor; Radiation Extraordinary Event Management; Radiological Environmental Impact of NPP operation.

The results of evaluation are stated in final reports of all evaluated areas and in summary report. The final report summarizes and evaluates severities of all the deviations identified in terms of their impact on defence in depth. Deviations identified are divided into four groups by safety relevance (high, medium, low, very low) and according to the recommendation arising from the assessment, matching safety findings are established and corrective measures with the time schedule for their implementation are proposed. Implementation of the PSR is required by the Atomic Act and its implementing regulations. The PSR results are crucial for obtaining and maintaining a licence for the operation of Dukovany NPP and Temelín NPP.

Overview of completed and prepared PSR:

PSR for the Dukovany NPP after 20 years of operation was executed in the years 2005–2006. PSR for the Temelín NPP after 10 years of operation was executed in the years 2008–2010. PSR for the Dukovany NPP after 30 years of operation was executed in the years 2013–2015. PSR for the Temelín NPP after 20 years of operation was executed in the years 2017–2020. Appropriate opportunities to enhance safety have been identified by comprehensive assessment in the framework of the PSR. The opportunities were also confirmed by the results of the stress tests performed in response to the accident at the Fukushima Daiichi NPP. The measures defined by the PSR for EDU after 20 as well as 30 years and the measures defined by the PSR for ETE after 10 years are implemented. The results of the PSR for ETE after 20 years of operation were submitted in connection with the renewal of a licence for the operation of Temelín NPP Unit 1. Measures defined during this PSR are currently being implemented. The preparation of the PSR after 40 years of operation begins at the Dukovany NPP in 2022.

The SÚJB reviews and comments on the results of the PSR and annually monitors implementation of the measures defined during the PSR. The licence holder shall notify the SÚJB of any changes to the time schedule for PSR measures and shall discuss them with the SÚJB.

Probabilistic Safety Assessment of the Dukovany NPP

The first Probabilistic Safety Assessment study (PSA) level 1 of the Dukovany NPP was completed in 1993. The analysis for limited number of internal initiating events and reactor operation at the nominal power was developed.

The level 1 PSA model was gradually extended. Scope of the analysis was extended to include other initiating events, such as internal fires, flooding, consequences of a high-energy pipeline break (HEPB), heavy load drops and human induced external events. The changes made at the nuclear power plant, which included the design changes, equipment replacement and alterations in the operating procedures, have been gradually incorporated into the model. Furthermore, redeveloped analyses (thermal hydraulic – Pressurized Thermal Shock etc.) have been included and human factor impact has been modelled in more details. Similarly, low-power conditions and refuelling outage have been included.

The first results of the level 2 PSA analysis establishing frequency of the radioactivity release into the environment during severe accidents were submitted to the SÚJB in April 1998. Level 2 PSA analysis has been processed only for power operation. In 2002, this analysis was updated through new input data based on the up to date results of the level 1 PSA model and has been thus incorporated into the Living PSA program. Another update of the level 2 PSA analysis was performed in 2006. Between 2010 and 2014, the level 2 PSA analysis for non-power conditions and shutdown was gradually incorporated into the portfolio of analysed risks for non-power conditions and shutdown. The comprehensive update of the full-scope level 1 and 2 PSA analysis for all operating conditions (i.e. nominal power, low power and shutdown) and for fuel located in both the core and the spent fuel storage pool was carried out in 2015.

The Shutdown PSA ("Shutdown Probabilistic Safety Assessment" – SPSA), i.e. the PSA for reactor low-power operation and for shutdown, was developed in 1999. The results showed that the total core damage contribution during outages is comparable to the contribution during operation at full power and is even higher in some outage conditions. Based on the Shutdown PSA results, new and more detailed emergency guidelines were developed. Some modifications in maintenance management and planning were also made.

Further to results of the level 1 and level 2 Living PSA study for the Dukovany NPP the effort was concentrated on a reduction of impact of the most significant accident sequences. Further changes in the design were made, some equipment was replaced and new emergency procedures were developed. All the planned major design changes of the power plant units relating to nuclear safety were evaluated, based on the results of the level 1 Living PSA study, and prioritized in terms of reduction of risk. The results of the Living PSA have also been used to support the development of new emergency operation procedures (EOPs) and abnormal operation procedures (AOPs) (level 1 Living PSA) and severe accident management guidelines (SAMGs) and procedures for the use diverse and mobile means (DAM) (level 2 Living PSA). New symptom-based procedures have been then incorporated into the PSA model (in 1998 for nominal unit power and in 2002 for shutdown conditions). Changes in these regulations as well as SAMGs and procedures for the use of DAM are, in the framework of the concept of the Living PSA, incorporated into the PSA models regularly.

With respect to some differences between the individual units of Dukovany NPP, the PSA model for Unit 1 was modified for other NPP units in order to show their actual state; therefore, the PSA models for Units 1, 2, 3 and 4 are currently available.

At the Dukovany NPP, replacement of Instrumentation and Control of safety systems (RTS, ESFAS) was gradually executed and this fact was also shown in PSA model. Presently, the replacement of Instrumentation and Control Systems of safety systems is completed at all units and integrated into PSA models.

The so-called Living PSA study for the Dukovany NPP is a permanent program and, as the previous text shows, the work covers the following two main areas:

- updating of the analyses, i.e. modelling of the changes to be made, updating of specific reliability data for the units and incorporation of more accurate supporting analyses into the model, inclusion of new, world-recognized methodological approaches, etc.;
- extending of the scope and portfolio of analysed events.

Between 2011 and 2013, some external initiating events caused by natural effects such as earthquake and adverse weather conditions, specifically extreme abrasive storms, extreme air temperature (high, low) etc., were pre-modelled in the PSA analyses.

All relevant external events caused by natural influences (earthquake, extreme wind, extreme temperatures, extreme precipitations, etc.) were gradually incorporated into the valid PSA model and included in the overall portfolio of risks in 2015 (influences of extreme weather) and in 2017 (earthquake).

All the modifications made on the basis of the findings of the stress tests following the accident at the Fukushima Daiichi NPP were incorporated into the level 1 and 2 PSA models in 2015.

The current PSA analysis contains a full scope of internal and external events caused by natural hazards as well as human activities for all operating modes and conditions of NPP. The current PSA-1 study establishes the resulting Core Damage Frequency (CDF) for all unit operation modes for Dukovany NPP as well as total Fuel Damage Frequency (FDF) representing the risk level of unit operation with fuel in core as well as with fuel in the spent fuel storage pool.

The current PSA-2 contains a full scope of internal and external events, and is prepared for all operating modes and conditions, and includes fuel in the storage pool. Relatively essential change was the change in definition of the Large Early Release Frequency (LERF), which currently includes all releases of radioactivity from the containment or reactor hall during outage exceeding 1 % of the initial amount of ^{137}Cs within 10 hours from core damage or from fuel exposure in the spent fuel storage pool.

The PSA for the Dukovany NPP is developed in accordance with applicable legislation, international standards of the IAEA, ASME-2 standard, relevant NUREG publications, EPRI (Electric Power Research Institute) publications and the SÚJB guides.

The PSA analysis is also utilized in some other applications (in addition to those mentioned above) such as adjustment of testing intervals for safety-important equipment, IAEA Safety Issues probabilistic assessment, adequacy assessment of existing Limits and Conditions (AOT), assessment of selected operational events.

The PSA study has been currently incorporated into the Living PSA program and consists of level 1 PSA and related level 2 PSA. Its conclusions are included in the Living PSA Summary Report for the respective year. The Summary Report presents detailed results for Unit 1 provided that different values for other units are always available, if required.

The following tables show comparison of the main results of the level 1 and 2 PSA study for individual units of Dukovany NPP (towards the end of 2020). The results include internal events and power grid failure and the so-called internal hazards (fires, floods, heavy load drops and flying objects).

Overview of CDF, FDF and LERF for individual units of Dukovany NPP – 2021

UNIT	CDF [$year^{-1}$]	FDF [$year^{-1}$]	LERF [$year^{-1}$]
1	**4.45×10^{-6}**	**5.56×10^{-6}**	**5.90×10^{-7}**
2	**4.48×10^{-6}**	**5.58×10^{-6}**	**5.80×10^{-7}**
3	**4.48×10^{-6}**	**5.58×10^{-6}**	**5.70×10^{-7}**
4	**4.54×10^{-6}**	**5.64×10^{-6}**	**5.90×10^{-7}**

Overview of CDF, FDF and LERF of Dukovany NPP Unit 1: for power and shutdown operational modes – 2021

UNIT 1	CDF [$year^{-1}$]	FDF [$year^{-1}$]	LERF [$year^{-1}$]
2 – 100 % N_{nom}	**2.94×10^{-6}**	**3.64×10^{-6}**	**3.90×10^{-7}**
N < 2 % N_{nom}	**1.51×10^{-6}**	**1.92×10^{-6}**	**2.00×10^{-7}**
Total:	**4.45×10^{-6}**	**5.56×10^{-6}**	**5.90×10^{-7}**

The results of external events are shown in last table. It includes the PSA results of natural hazards as well as human induced hazards.

Overview of CDF, FDF and LERF for individual units of Dukovany NPP: for external events – 2021

UNIT	CDF_{ext} [year^{-1}]	FDF_{ext} [year^{-1}]	$LERF_{ext}$ [year^{-1}]
1	1.36×10^{-5}	1.47×10^{-5}	3.71×10^{-6}
2	1.36×10^{-5}	1.47×10^{-5}	3.60×10^{-6}
3	1.35×10^{-5}	1.46×10^{-5}	3.68×10^{-6}
4	1.35×10^{-5}	1.46×10^{-5}	3.68×10^{-6}

Extreme snow load and extreme wind are the biggest contributors to the risk of external events. The contribution of seismic PSA to the risk is less significant. Of the human induced external events, only the “aircraft crash” event has a certain contribution to the risk, which, however, is negligible in comparison with the risk caused by natural influences.

The level 1 PSA study for full power unit operation was the subject of the IAEA IPERS inspection mission in 1998. Furthermore, an independent assessment of the PSA study (including analysis for shutdown conditions and level 2 PSA study) and its suitability for the use in applications initiated by the SÚJB was carried out by Austrian company ENCONET Consulting in 2005. Other IAEA inspection mission to the PSA for the Dukovany NPP (TSR PSA) was conducted in 2016 and comprehensively reviewed the models and documentation of level 1 and 2 PSA for all modes of operation, for internal and external events and also PSA suitability for the use in applications. An independent assessment was conducted by the Slovak company VÚJE Trnava, a. s., for the SÚJB in 2017 as to the analysis of reliability data used in the level 1 PSA for the analysis of internal initiating events in all operating modes.

From 2008 and every year thereafter, the SÚJB inspection is conducted concerning the project Living PSA of Dukovany NPP, verification of continued assessment of operational safety of the units of Dukovany NPP and assessment of risk profile during outages by means of risk monitoring “Safety Monitor of Dukovany NPP” and assessment of safety culture in the field of PSA analyses.

Probabilistic Safety Assessment of the Temelín NPP

The first probabilistic safety assessment of the Temelín NPP of level 1 and 2 was developed between 1993 and 1996.

The goal of the PSA project of the Temelín NPP was the assessment of the severe accident risks, to understand the most probable accident sequences that may occur at the plant, including their importance, to acquire quantitative understanding of the total Core Damage Frequency and frequency of release of radioactive materials and to establish the main contributors to such releases. The PSA project of the Temelín NPP included Level 1 PSA both in power operation, low-power operation and during shutdowns, and the evaluation of fire risk, flooding, seismic events and other external events. The project also included evaluation of the level 2 PSA. As to events, only the potential risks of sabotage and war were not assessed.

Since the beginning, PSA analyses have been drawn up as Living, including close involvement and development of the individual analyses by the NPP personnel to maintain result models in an actual status for risk-informed applications everyday use either by the PSA specialists or by the NPP operating personnel. One of the above-mentioned applications was also the risk monitoring of operation of both units at Temelín NPP. Upon these grounds, the work scope was extended. Between 1996 and 1999, the PSA basic models (for all operational states and PSA levels 1 and 2) were converted to develop a localized version of the Safety Monitor 2.0 or subsequently 3.0, 3.5 and 4.2 software from the

Scientech Company. The main purpose of this software and its related probabilistic models is to analyse the impact of both actual and planned configurations of the NPP, including impact assessment of maintenance activities and equipment tests for immediate operational risk level in all operating modes without the necessity to have any knowledge from the PSA field. The licence for this software was subsequently obtained for the Dukovany NPP.

In 2003, updating of the PSA analyses for the Temelín NPP was completed based on current state of the power plant during its commissioning. The analyses updated between 2001 and 2003 represented knowledge on the plant's response to emergency, current design and operational condition after the implementation of many safety improvements. This enabled impact assessment of safety related measures at the Temelín NPP, using the Core Damage Frequency and Large Early Release Frequency and thus acquires a more realistic estimate of the current safety level at the time of unit start-up and in their further operation.

In subsequent years, the PSA analysis was updated and external events caused by human activities were updated, of which only "aircraft crash" event has a certain contribution to the risk. External events caused by natural hazards (extreme wind, extreme weather, extreme high and low temperatures, seismic events etc.) have been updated in response to updating of the models of internal initiating events in the course of 2018. All the modifications made on the basis of the findings of the stress tests following the accident at the Fukushima Daiichi NPP were also incorporated into the level 1 and 2 PSA models in 2017 and 2018, in particular those affecting the value of CDF and LERF. The PSA for the Temelín NPP is included in the Living PSA program, therefore it is updated every year in accordance with the up to date status of the Temelín NPP design and procedures.

The Level 1 PSA analysis establishes the resulting Core Damage Frequency for all unit operation modes for Temelín NPP as well as total Fuel Damage Frequency representing the risk level of unit operation with fuel in core as well as with fuel in the spent fuel storage pool.

The current Level 2 PSA contains a full scope of internal and external events, and is prepared for all operating modes and conditions, and includes also fuel in the spent fuel storage pool. Relatively essential change was the change in definition of LERF, which currently includes all releases of radioactivity from the containment exceeding 1% Cs within 10 hours from core damage or from fuel exposure in the spent fuel storage pool.

The following tables show comparison of the main results of the Level 1 and 2 PSA for individual units of Temelín NPP (valid at the end of 2020). The results presented in the first two tables include internal events including power grid failure and the so-called internal hazards (fires, floods, heavy load drops and flying objects).

Overview of CDF, FDF and LERF for individual units of Temelín NPP – 2021

UNIT	CDF [$year^{-1}$]	FDF [$year^{-1}$]	LERF [$year^{-1}$]
1 and 2	**3.19×10^{-6}**	**4.74×10^{-6}**	**7.86×10^{-7}**

Overview of CDF, FDF and LERF for individual units of Temelín NPP Unit: for power and shutdown operational modes

Unit 1 and 2	CDF [year^{-1}]	FDF [year^{-1}]	LERF [year^{-1}]
2 – 100 % N_{nom}	**1.70 x 10^{-6}**	**3.19 x 10^{-6}**	**5.96 x 10^{-7}**
N <2 % N_{nom}	**1.49 x 10^{-6}**	**1.55 x 10^{-6}**	**1.90 x 10^{-7}**
Total:	**3.19 x 10^{-6}**	**4.74 x 10^{-6}**	**7.86 x 10^{-7}**

The results of external events are shown in last table. It includes the PSA results of natural hazards as well as human induced hazards.

Overview of CDF, FDF and LERF for individual units of Temelín NPP: for external events – 2021

UNIT	CDF_{ext} [year^{-1}]	FDF_{ext} [year^{-1}]	$LERF_{ext}$ [year^{-1}]
1 and 2	**1.44 x 10^{-5}**	**1.54 x 10^{-5}**	**1.83 x 10^{-6}**

Extreme low air temperatures, extreme snowfall, extreme winds and tornadoes are the biggest contributors to the risk of external events. Human induced external hazards contribute minimally to the overall risk.

At the same time, the PSA models were converted and migrated to the Safety Monitor environment version 4.2 from the Safety Monitor software version 3.5. The software operation, including models, is currently operated in the Temelín NPP network environment and is used especially for optimisation of maintenance activities both during operation and mainly during evaluation of each of the outages (time schedule of outage before its start, its potential change made in the course of outages and subsequent compliance evaluation of predicted and actual risk profile), as well as for assessment of the overall risk profile of operation of all units of Temelín NPP and Dukovany NPP, and for support of applications for the evaluation of allowed outage time (AOT). In 2021, work began on the transfer of the PSA model from the Safety Monitor software to the more modern Phoenix Risk Monitor environment (this software was obtained by the licence holder from EPRI).

The PSA study for Temelín NPP is developed in compliance with legislative requirements and international standards (IAEA publications, ASME 2 standard, NUREG publications, EPRI publications).

The PSA study for Temelín NPP was the subject of the inspections missions by the IAEA International Peer Review Service (IPERS) in 1995 (level 1 PSA, internal initiation events) and in 1996 (fires, flooding, external events including seismic events and level 2 PSA). Another IPSART mission took place in 2003 after update of this analysis. Similarly, an independent assessment of the PSA study initiated by the SÚJB was carried out by the Austrian company ENCONET Consulting in 2005. An independent assessment was conducted by the Slovak company VÚJE Trnava, a. s., for the SÚJB in 2019 as to the analysis of reliability data used in the level 1 PSA for the analysis of internal initiating events in all operating modes. In 2020 and 2021, the SÚJB initiated an independent assessment of other selected parts of PSA for the Temelín NPP, specifically the inclusion of risks caused by potential internal and external hazards conducted by the German organisation Gesellschaft für Anlagen- und Reaktorsicherheit gGmbH (SÚRO undertook this cooperation in terms of organisation in 2021).

The SÚJB inspection has been annually executed since 2009 concerning the project Living PSA of

Temelín NPP, verification of continued assessment of operational safety of the units of Temelín NPP by means of risk monitoring “Safety Monitor of Temelín NPP” and assessment of safety culture in the field of PSA analyses.

In accordance with legislation requirements, the PSA is gradually used in a number of other applications (in addition to those mentioned above) such as:

- Operational safety assessment – overall probabilistic safety assessment observed and presented as an integral part of the evaluation of key safety indicators.
- Severity analysis of operational events and hypothetical conditions (precursors to core damage) – risk assessment of the selected events from the operational history of units in terms of maintaining the level of safety margins in the course of the event and failure of NPP equipment.
- Identification of NPP weaknesses and proposals for corrective measures – the PSA methodology allows identifying relatively efficiently the systems, equipment and activities which are main contributors to the risk of NPP operation. On this basis, the appropriate corrective measures are proposed. These corrective measures are primarily the requirements for design modifications, changes to operating procedures, changes in the method for equipment operation and testing, modifications of operating and maintenance procedures.
- Assessment of upcoming equipment modifications designed to increase nuclear safety – the PSA is used for the assessment of the proposed modifications of NPP systems, structures and components to increase nuclear safety. The impact of these modifications on CDF reduction is assessed. CDF is one of the basic criteria for prioritizing the implementation of modifications. The assessment of contribution according to PSA is provided, inter alia, in the technical-investment specification of the modifications important to nuclear safety and is also part of the assessment of these projects.
- Assessment of upcoming or implemented changes to the procedures, in particular EOPs, SAMGs, EDMGs – the PSA methodology is used already in the phase of preparation of new procedures to make sure they include and address all scenarios which are the main contributors to the risk of core damage and modifications and additions to these procedures are proposed. Likewise, after the release of changes to procedures, these changes are incorporated into the PSA and the impact of the changes made is assessed. On this basis, any changes to procedures are recommended.
- Assessment of the intervals of equipment testing and equipment unavailability due to tests and repairs – using this PSA model it is possible to assess the impact of changes in test intervals of equipment and the impact of extending or shortening the unavailability of equipment due to testing and repairs on the nuclear safety. On the basis of the observed impact on CDF, FDF and LERF, the acceptance of these changes is assessed or any appropriate modifications are proposed. The assessment of the Limits and Conditions is conducted or any changes in the Limits and Conditions are proposed in this way.
- Operational risk profile monitoring of real NPP configurations using the Safety Monitor – the risk monitor “Safety Monitor” assesses the impact of equipment unavailability on the risk of operation in the given mode of the unit. The instantaneous value of the CDF and the LERF, the product of the increment in CDF and the duration of equipment unavailability are the rates of risk acceptance assessment of unit operation in the state and serves as a basis for a potential request for temporary change in the Limits and Conditions or as a basis for justifying the acceptability of temporary nonconforming operation (Basis for Continued Operation – BCO). The Safety Monitor can be used to calculate even the possible concurrences of highest risk concerning the unavailability of different equipment, which are permissible under the Limits and Conditions, but based on the assessment by the Safety Monitor, pose an increased risk, which is mainly carried out during online maintenance.

- The risk-informed assessment of outages – is conducted for the schedule of outages and the measures to reduce the risk are proposed. After outage, the planned risk is compared with the actual development of outage risk in the course of the safety assessment of the outages implemented. This is associated with the risk assessment of online maintenance, i.e. switching of the maintenance of safety systems to the full power operation (Mode 1), thus reducing the risk of outages.
- Identification of the risk-dominating accident scenarios for the purpose of preparation and training on full-scale simulator or to support emergency planning.
- Identification of safety significant systems, structures and components to support an Ageing Management Program, review the In-service Inspection Program and support the Final Safety Analysis Report and the PSR.

Continuous safety review

In accordance with the requirement set out in Section 22 of Decree No. 162/2017 Coll., on requirements for safety assessment according to the Atomic Act, the holder of a licence for the operation of a nuclear installation shall perform, throughout the life cycle of a nuclear installation, continuous safety assessment by assessing the current state of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security, and the way of meeting the principles of peaceful use of nuclear energy and ionising radiation. This assessment includes, in particular, assessment of the results of operational inspections and measurements, assessment of the effectiveness of management system, control of compliance of selected equipment, etc.

Special safety review

In accordance with the requirement set out in Section 22 of Decree No. 162/2017 Coll., on requirements for safety assessment according to the Atomic Act, the holder of a licence for the operation of a nuclear installation shall perform the so-called “special safety assessment” in several cases:

- before implementation of modification in the use of nuclear energy related to selected equipment,
- before implementation of modification in the use of nuclear energy related to organisation and management,
- before reaching the design lifetime of a nuclear installation,
- in case of radiation extraordinary event in a nuclear installation,
- in case of suspected reduction in the level of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management or security.

14.1.3 Regulatory practice

The SÚJB shall assess the level of nuclear safety in the course of all administrative procedures to issue a licence under the Atomic Act, its implementing regulations and the SÚJB guides, and with regard to international practice. Moreover, the SÚJB assesses the level of nuclear safety assurance particularly within the following activities:

- inspection activities,
- assessment of the modifications may not be approved,
- assessment of the periodically submitted Final Safety Analysis Report (requirements for its submittal are specified in the respective the SÚJB decision),
- evaluation of the program for the enhancement of safety of nuclear installations,
- periodic safety review.

In agreement with the Atomic Act, all results obtained by the SÚJB in the area of inspection and assessment of nuclear safety are submitted to the government on an annual basis. The results are also made available to the general public.

14.2 Verification of safety

14.2.1 Requirements for the verification of safety

As mentioned above in Chapter 14.1.1, pursuant to the provisions of Section 48 of the Atomic Act, the level of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security shall be regularly, systematically, comprehensively and verifiably assessed by the licence holder during the life cycle of a nuclear installation and the results of safety assessment shall be applied in practice. (For details concerning the requirements for safety verification in operation see Chapter 19, in particular Chapter 19.3 dealing with maintenance, inspections and tests.)

14.2.2 Programs for continuous verification of safety

Continuous verification of nuclear and technical safety is ensured at the Dukovany NPP and the Temelín NPP by introducing a comprehensive strategy of the maintenance of assets. The purpose of the maintenance of assets is to ensure such a state of assets that will ensure the safe and reliable operation of the nuclear installation. The strategy is based on a graded approach to equipment according to its importance (functional importance) and legislative requirements. The graded approach is based, among others, on the classification of equipment (classification of equipment into different categories), which is taken into account in the implementation of preventive maintenance (different scope of maintenance for equipment of different categorization).

Strategy and implementation of the maintenance of assets:

1. Records of assets/systems, structures and components (SSC) – records of process assets (SSC) of the power plant are kept in accordance with the management and working documentation including acquisition of basic data on assets.
2. Management of the physical configuration of assets (SSC) – conformity of the physical state of assets (SSC) with the configuration documentation is maintained in accordance with the management and working documentation.
3. Categorization of assets (SSC) – power plant SSCs are categorized by their relevance to safety and production into categories according to the approved methodology (ČEZ_ME_0608), prepared with the use of world practice (WANO, INPO 913, EPRI). The performed categorisation takes account of the relevance of equipment function for the fulfilment of safety and production requirements imposed on equipment; equipment is classified by relevance into three categories (category 1 – critical, category 2 – non-critical, category 3 – irrelevant).
4. Identification of specific equipment (Group A) – equipment for which, in addition to standard preventive maintenance methods, ageing management is ensured by implementing specific/component specific ageing management programs, or by developing time limited ageing assessment (TLAA) analyses. The specific equipment of Group A are as follows:
    - Safety-significant – i.e. the equipment performs the function of ensuring the integrity of the reactor coolant pressure boundary, the integrity of the containment/confinement and the function of preventing the leaks from containment/confinement with long life which is irreplaceable or difficult to replace.
    - Other crucial equipment to maintaining the operation of a power plant – equipment important to LTO.

5. Establishment of the preventive maintenance program and its implementation – the maintenance program is established in a graded approach based on equipment category. In addition to legislative requirements, it includes other preventive actions to maintain the required level of reliability and life durability of equipment. The program is developed with the use of the maintenance templates developed by NPP Design Modification Engineering Department and the Care of Assets Department, considering the international practice (EPRI).

   The categorization of equipment in setting the maintenance program in order to manage the reliability is considered in the graded approach as follows:

   - Specific systems Group A – preventive maintenance program is aimed at long-term reliability. The strategy is based on ageing management and the implementation of preventive maintenance program with the use of developed specific/component specific ageing management programs where it is insufficient to use only standard methods of preventive maintenance and performance monitoring. This is particularly applied to the equipment with important passive safety function (category 1 or category 2). This group of equipment is determined in accordance with the relevant management documentation.
   - SSC category 1 – preventive maintenance program is aimed at high reliability and failure elimination with the use of standard methods of preventive maintenance. Reliability management is performed on the basis of monitoring of the performance and state with the use of standard methods of preventive maintenance.
   - SSC category 2 – preventive maintenance program is aimed at prevention of undesired failures (safety consequences for personnel, the environment, high financial loses, etc.) with the use of standard methods of preventive maintenance. Ageing/reliability management is performed on the basis of monitoring of the state with the use of standard methods of preventive maintenance.
   - SSC category 3 – no maintenance program is set; this category is managed by assessing the efficiency of simple maintenance or equipment replacement, and equipment is in operation until corrective maintenance.

An integral input for the setting of preventive maintenance program is:

6. In-service Inspections Program – in-service inspections are carried out in accordance with the in-service inspection program prepared by a licence holder and approved by the SÚJB. Components important to nuclear and technical safety are included into the ISI program; selection of these components is given by design. The In-service Inspections Program consists of the individual In-service Inspections Sub-programs developed under the original quality assurance programs (Individual Quality Assurance Programs) and according to the documentation of design modifications. Within the In-service Inspection Sub-programs for technological systems or individual selected equipment, the place of inspection, inspection method with the period (interval of in-service inspection) and acceptance criteria are specified. The results of in-service inspections are regularly evaluated and based on this evaluation, with additional accounting of operational experience, legislative requirements and experience from other operated nuclear power plants, the in-service inspection program is optimized.

   The requirements for inspection activities specified in this program are taken into account in the maintenance program.

   Within the in-service inspections, the following methods are mainly used: visual testing, penetration testing, radiography, eddy currents testing, ultrasonic testing, ultrasonic thickness measurement, tightness and pressure tests, diagnostic measurements. The range and number of these methods depend on the particular component's importance. On safety-relevant components, NDT methods are qualified with the use of the European Network for Inspection Qualification (ENIQ) methodology.

Inspections in difficult to access locations or in locations with high radiation exposure are carried out by automated (manipulators and robots) methods. These are usually carried out by maintenance contractors, mostly manufacturers of the monitored equipment or specialized companies with the required qualification.

7. **Continuous monitoring and evaluation of performance and state** – SSC performance and state monitoring is used to evaluate the state and SSC reliability/life durability and includes:
   - Operational monitoring ensured by the operations divisions according to the relevant operating and management documentation.
   - Preventive plant walkdowns– ensured by the Care of Assets Department.
   - Performance and state evaluation – ensured by the Care of Assets department and Technical Support department with the use of data acquired from operational monitoring, from preventive maintenance (including the results of the inspections according to the operational inspections program and revisions according to the Rules of Revision), from the results of the Ageing Management Programs, and from internal and external feedback. The evaluation is carried out on the basis of defined parameters and criteria.

   Periodic evaluation of the SSC state (summarized in Health Reports of Systems) is the comprehensive form of evaluation.

   Enhancement of the SSC reliability – on the basis of performance and state evaluation, and the results of the care of assets programs, the nonconformities identified in performance and state are, in a graded approach, recorded, assessed (including possible impact of ageing) and investigated, and the priority and method for their solution are set so as to achieve the required reliability of the SSC.
8. Periodic evaluation of the SSC state (Health-report) – SSC performance and equipment/component are comprehensively observed on the basis of the set parameters linked to reliability management (safety, deficiencies and operational events, physical condition, economic indicators, the implementation of specific projects, ageing assessment, and reliability assessment). On the basis of periodic assessment, the maintenance program is optimized, while keeping the graded approach. This periodic assessment of the state and performance is carried out for technological systems and components.
9. Integration of ageing management into the process of the Maintenance of Assets – activities related to ageing management of specific components (category A) and ageing-related issues are implemented in the NPP Ageing Management process. They are tied to maintenance of assets and are ensured by NPP Long-term Operation Preparation Department including implementation of Ageing Management Programs.
10. Monitoring and recording of the SSC risks – in the form of the Health Report of Power Plant (ZSE).

14.2.3 Ageing management and long-term operation (LTO)

The general requirements for ageing management have been included in Czech legislation since the beginning of the use of nuclear energy. This was, for example, Act No. 28/1984 Coll., and its implementing regulations. Legislative documents have been updated over time on the basis of the current state of knowledge, the results of science and technology, and the increasing need for enhancing nuclear safety.

Detailed requirements are currently implemented in the Atomic Act, which includes the requirements for implementation of the ageing management process defined in the Ageing Management Programs, with detailed specification of these requirements included in the implementing regulations. Concurrently the requirements arising from the IAEA Safety Principles and Requirements and WENRA Safety Reference Levels (Criteria) are incorporated into the relevant documents. The definitions and procedures concerning requirements for ageing management are the subject of the SÚJB Safety Guide BN-JB-2.1, Ageing Management for Nuclear Installations.

The ageing management of the SSC includes three basic activities:

1. Scoping and screening process of the SSCs that should be subject to ageing assessment.
2. Understanding dominant ageing effects/mechanisms of the SSCs selected within the screening process and finding or developing effective and usable methods for monitoring and mitigating their ageing effects.
3. Ageing degradation management of specific SSCs by implementing effective measures in the field of in-service inspections, maintenance and management of facility operation.

All those obligations shall be documented by the licence holder in the overall Ageing Management Program, under which the entire process shall take place. The above obligations shall also be reflected in the Ageing Management Programs at the level of selected components (the so-called "Component Specific Ageing Management Program") and in the programs targeted at a specific degradation mechanism or ageing effect (the so-called "Specific Ageing Management Program"). The overall Ageing Management Program in ČEZ, a. s., is set for both sites and includes requirements of the relevant IAEA Standards, IAEA Safety Guides (including SSG-48 Ageing Management and Development of a Program for Long Term Operation of Nuclear Power Plants) and WENRA Safety Reference Levels. The way of quality assurance for the process of ageing management as required in Decree No. 21/2017 Coll., is defined and described in the document ČEZ_PG_0001 Operational Ageing Management Program for NPPs. More information about the overall Ageing Management Program can be found in the report to the Topical Peer-Review (TPR), [14-1].

Since Dukovany NPP has already achieved its original lifetime limit set by design, and ČEZ, a. s., declared a strategic goal for its NPPs to extend their life span by 20 to 30 years as a minimum, the LTO Program was implemented in accordance with international best practice. Therefore, ČEZ, a. s., took active part in the IAEA Safety Aspects of Long Term Operation (SALTO) Program and is involved in all working groups as well as the steering committee of the ongoing international program called the IAEA International Generic Ageing Lessons Learned (IGALL) Program, which is currently participated by 32 countries operating NPPs. In accordance with the requirements of Section 49(1) s) of the Atomic Act and Sections 11 and 12 of its implementing Decree No. 21/2017 Coll., an Operational Ageing Management Program (hereinafter referred to as the "OAMP") is implemented in ČEZ, a. s. The method of ensuring ageing management is given in relation to the area of management and their processes implemented in the Nuclear Energy Division.

List of systems, structures and components subject to ageing management process

The requirement for Scoping of the systems, structures and components subject to the ageing management process (Scope of AM) is generally defined in Decree No. 21/2017 Coll. The following have to be included in the selection of systems, structures and components subject to the ageing management process:

- selected equipment of the Safety Class 1, 2, and 3, and
- systems, structures and components relevant to nuclear safety, which are not the selected equipment.

To fulfil the requirements of Decree No. 21/2017 Coll., the methodology ČEZ_ME_0987 – Selection and Assessment of Equipment for Ageing Management, following criteria for the selection of systems subject to the ageing management process are set out:

- selected equipment with the assigned Safety Class 1, 2, 3 according to Decree No. 329/2017 Coll.,

- not selected equipment with an impact on nuclear safety. According to ČEZ_ME_0054, the equipment resulting from the probabilistic assessment to verify the SCOPE of the ageing management according to Section 11(3) of Decree No. 162/2017 Coll., are included herein,
- equipment recommended from the world good practice, operating experience and outcomes of commission walkdowns.

Graded approach to ageing management

To ensure the required service life of the SSC, a graded approach is implemented to ageing management according to the standard ČEZ_ST_0072 – Requirements for NPP Reliability Management. The graded approach is selected on the basis of the strategy defined for the care of the SSC.

Specific equipment of Group A

Ageing management using Specific and Component Specific Ageing Management Programs (AMPs) or TLAA analyses is applied when the ageing management of systems cannot be ensured only by using standard methods of preventive maintenance. The list of equipment for which the ageing management is ensured by introducing the Component Specific AMPs or by preparing TLAA analyses, results from the strategies for care of the SSCs and is given by a List of Specific Equipment (Category A), which is the outcome of the implementation of activities under working procedure ČEZ_PP_0425.

List of currently implemented Specific and Component Specific Ageing Management Programs in ČEZ, a. s.

- AMP for Low-Cycle Fatigue – Passive Mechanical Components,
- AMP for Erosion Corrosion – NPP Secondary Circuit Piping,
- AMP for Radiation Damage to Reactor Pressure Vessels in NPP,
- AMP for Spent Fuel Pool and Refuelling Pools in the Dukovany NPP,
- AMP for Visual Inspections of Cables,
- AMP for Civil Structure Parts of Pools with Double Liner in the Temelín NPP,
- AMP for Civil Structure Parts of Containment in the Temelín NPP,
- AMP for Cooling Towers of NPP,
- AMP for Service Water Piping,
- AMP for Containments in the Dukovany NPP,
- AMP for Areas at Risk with Weld Joints in NPP,
- AMP for Monitoring of Dukovany NPP Buildings,
- AMP for Monitoring of Civil Structures of the Dukovany NPP,
- AMP for Passive Components of Main Circulation Pumps,
- Component Specific Ageing Management Program – reactors,
- Component Specific Ageing Management Program – passive components of the main isolation valves,
- Component Specific Ageing Management Program – pressurizers,
- Component Specific Ageing Management Program – containments in EDU, ETE,
- Component Specific Ageing Management Program – steam generators,
- Component Specific Ageing Management Program – pipelines and sections of Safety Class 1,
- Component Specific Ageing Management Program – safety relevant cables of NPP,
- Component Specific Ageing Management Program – spent fuel pools and refuelling pools,
- Component Specific Ageing Management Program – valves with actuators in NPP,

- Component Specific Ageing Management Program – power oil transformers,
- Component Specific Ageing Management Program for Castors,
- Component Specific Ageing Management Program – high-energy pipelines of NPP.

In the years 2020–2021, new AMPs were introduced:

- Component Specific Ageing Management Program – NPP pools and shafts, which replaced three ageing management programs: AMP for Dukovany NPP Spent Fuel Storage Pool, AMP for Civil Structure Parts of Pools with Double Liner in the Temelín NPP and Component Specific Ageing Management Program – spent fuel pools and refuelling pools,
- Component Specific Ageing Management Program – monitoring of civil structures of NPP, which replaced two ageing management programs – AMP for Monitoring of Civil Structures of the Dukovany NPP and AMP for Cooling Towers of NPP,
- Component Specific Ageing Management Program for NPP Containments, which replaced the Component Specific Ageing Management Program for Containments (CNTN) in the Dukovany NPP, Temelín NPP as well as AMP for Civil Structure Parts of Containment (CNTN) in the Temelín NPP and AMP for Containments (CNTN) in the Dukovany NPP,
- Component Specific Ageing Management Program – safety relevant cables of NPP newly covered AMP for Visual Inspections of NPP Cables,
- AMP for radiation and fatigue damage to NPP reactor internals,
- AMP for vibration damage to NPP reactor internals,
- and the Component Specific Ageing Management Program – safety relevant cables of NPP was updated to cover specific AMP for Visual Inspections of NPP Cables.

Review and assessment

The review of the ageing management by the SÚJB and the associated licensing procedure necessary to issue a licence for the extended operation of Dukovany NPP after 30 years included a wide range of activities. Regardless of the good results of national and international assessments, it revealed the need to improve certain areas. Many corrective measures were completed on time, but from the results of the assessment and inspection activities of the SÚJB areas for potential improvement were defined, for example, in settings of some processes and activities or documentation quality. For this reason, the SÚJB formulated the Conditions of Permit on Dukovany NPP Operation individually for all units (i.e. for their LTO).

From an international perspective, the system was verified by full-scope SALTO missions, which took place at the Dukovany NPP in 2008 (Follow-up in 2011) and 2014 (Follow-up in 2016).

More information about the ageing management can be found in the report "Topical Peer-Review", "Ageing Management" under the Nuclear Safety Directive 2014/87/EURATOM [14-1][9]. This was the first Topical Peer Review (TPR), whose performance results from the Nuclear Safety Directive 2014/87/EURATOM of the European Union and took place in Luxembourg in May 2018. Preparation for this review began in 2015 and the result of preparation was the National Assessment Report of the Czech Republic [14-1].

The objective of the Peer-Review was to undertake a peer review of established practices in the area of ageing management, to identify strengths and weaknesses of good practices and to define areas for improvement. Further to share operating experience and also to provide a transparent and open framework for developing and implementing appropriate follow-up measures to address areas for improvement. The TPR includes all nuclear power plants and research reactors with a thermal power

[9] https://www.sujb.cz/fileadmin/sujb/docs/eng/reports/TPR_NaCP_CR_AJ_F.pdf

equal to 1 MWt, or more that were operating on 31 December 2017 or were under construction on 31 December 2016.

The groups of components were then set as examples of the implementation of the overall Ageing Management Program, of which the following groups were covered by the scope of the TPR for the Czech Republic: electrical cables, concealed (inaccessible) pipework, reactor pressure vessels and concrete containment structures.

The National Assessment Report of the Czech Republic for TPR contains a description of the Overall Ageing Management Program focusing on program aspects of the ageing management process, implementation of that Overall Ageing Management Program and experience with the application of ageing management. The descriptive part is followed by the evaluation of compliance with the national and international requirements, identification of the strengths and weaknesses of the process and definition of the areas for improvement.

14.2.4 Evidence of safety submitted to the SÚJB

The most significant evidence of safety, prepared over recent years, was:

- the Summary Evidence of the Readiness of Dukovany NPP Unit 1 to 4 for LTO, always separately for each Dukovany NPP unit. It was prepared within the operation extension activities of Dukovany NPP Units 1 to 4 and submitted along with the application for a licence for the operation of the relevant Dukovany NPP unit to the SÚJB. Their assessment and approval took place at the SÚJB in the years 2015–2017.
- the Summary Evidence of the Readiness of Temelín NPP Unit 1 and 2, always separately for each Temelín NPP unit. It was prepared within the operation licence renewal activities of Temelín NPP Units 1 and 2 and submitted along with the application for a licence for the operation of the relevant Temelín NPP unit to the SÚJB. The assessment for Temelín NPP Unit 1 took place at the SÚJB in the years 2019–2020. At present (2021–2022), the certificate of readiness of the installation, personnel and internal regulations for the operation of the nuclear installation Temelín NPP Unit 2 is being assessed. The submitted documents included the results of PSR ETE 20.

The company ČEZ, a. s., consulted the requirements concerning the Evidence of Readiness for LTO of individual units of the Dukovany NPP or for further operation of the Temelín NPP and its content with the SÚJB on a continuous basis. Preparation of LTO or renewal of the operation licence and Evidence of Readiness were ensured by the LTO program or the operation licence renewal program, which consisted of the project part and of the management systems carried out in line under responsibility of the competent directors of divisions. The Program Manager was responsible for program management. Sponsor of the program provided for the conditions for program implementation within the company ČEZ, a. s., i.e. financial and human resources for implementation, and the Management Committee checks work and approves changes and documentation. Each of the projects was carried out by a project team, led by a project manager. To ensure consultation support and independent opposition procedure, three groups of experts were set up:

- Team of the company ČEZ, a. s., composed of specialists, who were and are involved in the preparation of the new nuclear unit in the Czech Republic.
- Examination and analytical team, which ensures the assessment of documents in terms of knowledge of existing legislative practice, detects any risks and potential (foreseeable) directions in problem solving.
- Independent expert team, which reviews the outputs and proposes the feedback to the Management Committee and the Program Manager.

During the approval process at the SÚJB, all documentation was submitted along with the application for a licence for LTO or for operation discussed with the applicant and subsequently assessed in detail within the administrative proceedings.

14.2.5 Regulatory practice

Regulatory practice to be performed by the SÚJB is defined in the Atomic Act, Sections 200 through 204 and in Act No. 255/2012 Coll., on Inspection (Inspection Code). Section 200 of the Atomic Act sets out the authority for the SÚJB (inspectors) to inspect compliance with this Act. Section 203 of the Atomic Act gives the inspectors the right to issue binding instructions within the meaning of the prohibition of the activity, operation, handling of nuclear material, etc. According to Section 204, the SÚJB is also authorized to impose corrective measures if the SÚJB finds a deficiency in the activities related to the use of nuclear energy or in exposure situation. (For more legislative details see Chapter 7.)

In terms of planning, inspection activities are carried out by the SÚJB in the form of:

- planned inspection,
- unplanned inspection (the so-called "ad hoc inspection").

In terms of the type of inspection, the following inspections are performed:

- routine inspections,
- specialized inspections.

Routine inspections are usually performed by site inspectors; these inspections are aimed to verify compliance with the general requirements and conditions of nuclear safety, state of a nuclear installation, compliance with the Limits and Conditions, monitoring programs and selected operating instructions. Routine inspections are performed in line with the plan of routine inspections, according to the relevant internal regulations of the SÚJB and include team inspections performed in connection with the outage of individual units. Specialized inspections verify that the selected area is in accordance with the approved inspection plan or on an unplanned basis, based on specific events. These inspections are usually performed by one inspector in the case, for example, of inspection in one area or one system, or by several inspectors (team inspections), usually in the case of inspections of several systems or in several areas simultaneously.

The inspection activities include the inspection of design modifications and compliance with the conditions of the decisions issued by the SÚJB including decision on a licence for operation.

In agreement with the Atomic Act, all results obtained by the SÚJB in the area of inspection and assessment of nuclear safety are submitted to the government on an annual basis. The results are also made available to the general public.

Statement on the implementation of the obligations concerning Article 14 of the Convention

In agreement with the requirements of Article 14 of the Convention, the Czech licensee performs comprehensive and systematic safety evaluation before a nuclear installation construction, commissioning and throughout its whole service life. The evaluation is documented and regularly updated at prescribed intervals to reflect operating experience and significant new scientific and technological information relating to nuclear safety and, in compliance with the Atomic Act, assessed by the responsible regulatory body. The requirements of Article 14 of the Convention are thus fulfilled.

15. RADIATION PROTECTION

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

15.1 Legislation in the field of radiation protection

Radiation protection including radiation protection in a workplace with nuclear facility (i.e. category IV workplace) is regulated by the Atomic Act and its implementing regulations – in particular Decree No. 422/2016 Coll., on radiation protection and security of a radioactive source, and Decree No. 360/2016 Coll., on radiation situation monitoring.

Legislation in the field of radiation protection is consistently based on internationally recognized principles of radiation protection based on the recommendations of the ICRP. The Publication ICRP 103 can be considered as the key document. The Council Directive 2013/59/Euratom of 5 December 2013 has been transposed into legislation. Legislation is in full compliance with the IAEA standards.

In the field of radiation protection, the Atomic Act sets down the principles and general rules, regulates the conditions of carrying out activities in exposure situations and obligations of the individual actors. The basic principles of radiation protection are highlighted:

- Justification principle;
- Optimisation principle;
- Dose limitation principle;
- Source security principle.

Section 9 of the Atomic Act establishes activities for which a licence issued by the SÚJB is required. From the perspective of radiation protection in the workplace with nuclear facility, a licence shall be required for the performing the following activities:

- The operation of category IV workplace;
- The carrying out of reconstruction or other modifications affecting radiation protection, radiation situation monitoring and radiation extraordinary event management in a category IV workplace;
- The individual phases of decommissioning of a category IV workplace;
- The discharge of a radioactive substance from a workplace;
- The management of an ionising radiation source;
- The performance of services important to radiation protection;
- The provision of services in the controlled area to the operator of a category IV workplace.

In relation to radiation protection in a workplace with nuclear facility, the Atomic Act imposes mainly the following obligation upon a licence holder:

- Licence holders shall act in accordance with the documentation for the licensed activity, keep it in compliance with the requirements under this Act, the principles of good practice and the actual status of the licensed activity. The holder of a licence for operation of category IV workplace shall present the monitoring program and on-site emergency plan to the SÚJB for approval.

- Licence holders shall notify the SÚJB without delay of any changes or events important to radiation protection, radiation situation monitoring, and security.
- Licence holders shall investigate without delay any breaches of this Act, take corrective action and prevent the recurrence of such situations.
- Licence holders shall comply with the technical and organisational conditions for the safe operation of nuclear installations and workplaces with an ionising radiation source, and technical and organisational conditions for the safe management of an ionising radiation source.
- Licence holders shall monitor, measure, evaluate, verify, and record quantities and facts important to radiation protection, radiation situation monitoring, and security, and retain and forward information about them to the SÚJB.
- Licence holders shall keep and retain a register of ionising radiation sources and forward data from the register to the SÚJB.
- Licence holders shall ensure monitoring of the doses from all work activities of exposed workers and compare the sum of the doses with the limits for exposed workers; forward the results of individual monitoring of an exposed worker to another licence holder or registrant person for whom the exposed worker also performs work activities; immediately notify the SÚJB of exceeding of the exposure limit.
- Licence holders shall allow only a person authorised for the management of ionising radiation sources under this Act to manage these sources; immediately notify the SÚJB of each case of unauthorised access or serious damage to the ionising radiation source.
- Licence holders shall classify the ionising radiation source used in the appropriate category; ensure that the characteristics of ionising radiation sources are evaluated by means of acceptance test and long-term stability test; perform verification of the characteristics of an ionising radiation source by means of operational stability tests; and use an ionising radiation source in accordance with the instructions for its use.
- In workplaces where radiation activities are performed, licence holders shall draw up and make permanently available intervention instructions and internal regulations.
- Licence holders shall inform exposed workers about the facts important to radiation protection relating to the performance of their work; ensure continuous training of exposed workers, verify their knowledge and document this continuous training.
- Licence holders shall equip exposed workers with personal protective equipment of a sufficient shielding effect and with appropriate protective accessories.
- Licence holders shall, if they manage an ionising radiation source or provide a service in a controlled area to an operator of a category IV workplace, perform annually an evaluation of the method of radiation protection assurance for the activity performed and forward the evaluation to the SÚJB by April 30 of the following year.
- Licence holders shall document and report to the SÚJB the implementation of modifications related to radiation protection and radiation situation monitoring in a workplace with an ionising radiation source.
- Licence holders shall ensure continuous surveillance of radiation protection within a scope corresponding to the activities performed, the way of management of the ionising radiation source and the level of possible exposure, including potential exposure. In order to perform continuous surveillance of radiation protection at a nuclear power installation, the operation licence holder of a category IV workplace shall set up a specialised radiation protection unit, which shall be organisationally independent of the licence holder’s operating and production units.
- Under the circumstances set down in the Atomic Act, the licence holder shall delineate a controlled area or supervised area, document their operation and ensure radiation protection of natural persons entering them.

- Licence holders shall comply with the conditions for the safe operation of a workplace with an ionising radiation source.
- Licence holders shall ensure individual monitoring of exposed workers and monitoring of the workplace depending on the scope and way of the activities performed; and determine the monitoring levels and procedures in the event they are exceeded in accordance with general procedures in the case of their exceeding set by the implementing regulation.
- Licence holders shall provide occupational medicine services to exposed workers including periodic medical examination of exposed workers of category A, at least once a year.
- Licence holders shall ensure the monitoring of discharges and the surrounding area; and determine the monitoring levels and procedures in the event they are exceeded in accordance with general procedures in the case of their exceeding set by the implementing regulation.

The Atomic Act regulates the conditions for the release of radioactive substances from the workplace. A licence issued by the SÚJB is required for discharges of radioactive substances from the workplace with nuclear facility into the air or into surface waters. Other radioactive substances can be released from this workplace either based on the SÚJB licence or after the prior notification to the SÚJB provided that the effective dose of each member of the public received in a calendar year by releasing radioactive substance is less than 0.01 mSv.

Decree No. 422/2016 Coll. determines exposure limits and specifies the procedures for optimising radiation protection. The Decree defines the exemption levels and regulates the categorization of ionising radiation sources of the workplaces where radiation practices are performed, and of exposed workers. Furthermore, it provides a list of the quantities and facts important to radiation protection, the details of the tests of ionising radiation sources and record keeping.

The Decree also regulates, for example, the details of the form and scope of radiation protection during radiation practices – details to continuous surveillance of radiation protection, to controlled and supervised areas, to exposed workers (personnel), documentation, operation of the workplace, changes in radiation protection and monitoring, defines clearance levels and states the details to the security of radionuclide sources.

Decree No. 360/2016 Coll., regulates, among other things, the details of the monitoring of discharges from workplace and of radiation situation monitoring in the territory of the State during normal and emergency monitoring. It defines the monitoring networks, monitoring sites and monitored items. It sets down the requirements for the form and method of radiation situation monitoring, for measuring and sampling equipment, and for the measuring laboratories. It regulates the details for the transmitting of monitoring data, defines the content of the National Monitoring Program and sets down the requirements for the discharge monitoring program and the monitoring program of the workplace surroundings.

15.2 Application of the requirements for radiation protection by the SÚJB

The Atomic Act defines the obligations and powers of the SÚJB. In the field of radiation protection at category IV workplaces, the SÚJB is particularly authorized to issue a licence for the performance of activities in exposure situations (see Chapter 15.1) and approve documentation for licensed activities. For operation of the category IV workplace, the approved documentation is the Monitoring Program, On-site Emergency Plan and the Determination of the Emergency Planning Zone (unless approved under a licence for the operation of a nuclear installation). For the individual phases of decommissioning of the category IV workplace, the approved documentation is the Monitoring Program and the On-site Emergency Plan. Changes to the approved documentation must be also submitted for approval.

Other documentation and its changes shall be submitted by the applicant or licence holder to the SÚJB for review for compliance with legal requirements. These include, for example, radiation protection optimisation procedures, controlled area delineation, supervised area delineation, list of workers who will perform activities specifically important to radiation protection, management system program.

When optimising radiation protection, any person who performs activities involving exposure situations shall specify the variants of radiation protection and choose the optimal variant. The selection of the optimal variant of radiation protection ensuring shall be performed by comparing options to reduce the planned and potential doses of natural persons or groups of members of the public. The measures taken to protect individuals or groups of members of the population against the influence of an of ionising radiation source shall be preferably applied at the ionising radiation source and can be also applied in the environment between the ionising radiation source and the individual, or on the individual level.

In planned exposure situation the licence holder must set down dose constraints for a specifies period in the Monitoring Program for the optimisation of exposure of workers and use the dose constraints set by the Atomic Act for the optimisation of exposure of the public.

Anyone who performs activities in exposure situations shall regularly use the procedures for the optimisation of radiation protection so as not to omit the newly established conditions for the relevant exposure situation or new possibilities of radiation protection for the exposure situation, in particular if the exposure limits, set dose constraints or reference levels are exceeded.

15.3 Licensee procedures in radiation protection

15.3.1 Individual exposure monitoring

The exposure limits are set down in Decree No. 422/2016 Coll.

The general limits for public exposure from all licensed or registrant activities per calendar year are 1 mSv for the sum of effective doses from external exposure and committed effective doses from internal exposure; 15 mSv for the equivalent dose for the eye lens; and 50 mSv for the average equivalent dose per cm^2 of the skin regardless of the size of exposed surface.

The general limit for exposed workers is 20 mSv for the sum of effective doses from external exposure and committed effective doses from internal exposure per calendar year. Furthermore, 100 mSv for the equivalent dose in the eye lens over any 5 consecutive years and simultaneously 50 mSv per calendar year; 500 mSv for the average equivalent dose per cm^2 of the skin per calendar year regardless of the size of exposed surface; and 500 mSv per calendar year for the equivalent dose in the upper extremities from the fingers to the forearm and in the lower extremities from the feet to the ankles.

According to Decree No. 422/2016 Coll., the limits for exposed workers are regarded as not exceeded if quantitative indicators expressed in measurable quantities (the so-called “derived limits”) have not been exceeded. The derived limits for external exposure are 500 mSv per calendar year for the annual individual dose equivalent at a depth of 0.07 mm $H_p(0.07)$; 20 mSv per calendar year for the annual individual dose equivalent at a depth of 10 mm $H_p(10)$; and 20 mSv per calendar year for the annual individual dose equivalent at a depth of 3 mm $H_p(3)$. For simultaneous external and internal exposure over a calendar year, the limits for exposed workers are regarded as not exceeded if the following conditions apply simultaneously:

$\boldsymbol{H_p(0,07) \leq 0,5\,Sv}$ and at the same time $\boldsymbol{H_p(10) + \sum_i h_{i,ing} I_{i,ing} + \sum_i h_{i,inh} I_{i,inh} \leq 0,02\,Sv}$,

where $\boldsymbol{h_{i,ing}}$, $\boldsymbol{h_{i,inh}}$ refers to the conversion factor for individual radionuclide intake by ingestion or inhalation,

$\boldsymbol{I_{i,ing}}$, $\boldsymbol{I_{i,inh}}$ refers to an individual radionuclide annual intake by ingestion or inhalation.

The monitoring of the exposure of individuals at the Dukovany NPP and the Temelín NPP is described in the Personal Monitoring Program. The Program sets, among other things, the investigation intervention monitoring levels, and describes the activities when these are exceeded. Furthermore, the operator of both NPPs set down the dose constraint of effective dose of exposed worker to 10 mSv. This value is the upper limit of the expected effective doses of exposed workers achieved cumulatively from the beginning of a calendar year.

The operator of both nuclear power plants monitors daily exposure of exposed workers, evaluates worker's exposure and submits the results to the SÚJB in monthly reports. All cases of exceeding the investigation or intervention monitoring levels are continuously investigated; this information is also included in the monthly reports.

The individual doses of exposed workers at both nuclear power plants are traditionally low; in the period from 2016 to 2021, the highest annual effective dose of exposed worker at the Dukovany NPP and at the Temelín NPP was 9.65 mSv and 4.19 mSv, respectively.

15.3.2 Optimisation of radiation protection

The operator of both nuclear power plants shall proceed in the optimisation in accordance with legislation requirements. The operator shall assess and compare the variants of solution to radiation protection before the commencement of particular activity. For this purpose, among other things, a sophisticated system of workplace monitoring and rooms labelling is used. The rooms are categorized by dose rate, surface contamination or contamination in the air.

Protection of workers is provided in a graded approach depending on the radiation situation in the affected rooms or workplace. Where worsened radiation situation is expected, radiation situation is checked before the commencement of work and according to the measurement results, appropriate protective equipment and resources are determined, and the working procedure is defined. If necessary, exercise of the activity is conducted to shorten its duration, or to avoid potential complications.

Workplace monitoring is described in the Workplace Monitoring Program at each power plant, which is approved by the SÚJB. All cases of exceeding the specified investigation or intervention monitoring levels are investigated and their causes are identified. In the case of non-standard conditions, feedback is applied. Information on the results of workplace monitoring, including exceeding of the monitoring levels, is submitted to the SÚJB in the monthly reports.

The effectiveness of the optimisation procedures is demonstrated by the relatively low individual doses of exposed workers and collective doses that are among the lowest ones in comparison with nuclear power plants of the same type in the world. Annual individual and collective doses are higher for the suppliers' employees than for the nuclear power plant operator's own employees and strongly depend on the amount and type of work performed during refuelling outages. In the period from 2016 to 2021, the highest annual collective dose of exposed workers at the Dukovany NPP and Temelín NPP was 834 mSv and 301 mSv, respectively.

15.3.3 Release of radioactive materials from the workplace

For optimisation of public exposure, the Atomic Act sets the general dose constraints of effective dose of the representative person of 0.25 mSv per year and in the case of nuclear power installation, simultaneously 0.2 mSv for discharges into the air and 0.05 mSv for discharges into surface waters.

Both nuclear power plants have a licence for the discharge of radioactive substances from the workplace into the air and surface waters issued by the SÚJB, where the SÚJB set the authorized limits of effective dose of the representative person. New approval was issued for Dukovany NPP in 2021, setting the authorized limit of 6 µSv for discharge into the air and 6 µSv for discharge into surface waters; the approval issued for Temelín NPP in 2017 set the authorized limit of 40 µSv for discharge into the air and the new approval issued in 2021 confirmed the authorized limit of 3 µSv for discharge into surface waters. The authorized limits were set based on the optimisation study and calculation of the dispersion of radioactive substances in the environment under conservative conditions by using the validated computer program. In addition, the competent water management authority issued a licence for the discharge of radioactive substances into surface water, in that the maximum volume activity of certain radionuclides in effluents is set.

Monitoring of discharges from the workplace is conducted on the basis of the Discharges Monitoring Program approved by the SÚJB. It is implemented by the operator through its specialized units and laboratories. All cases of exceeding the specified investigation or intervention monitoring levels are investigated and where possible, their causes are identified. In the case of non-standard conditions, feedback is applied. Information on the results of discharge monitoring, including exceeding of the monitoring levels, is submitted to the SÚJB in the monthly reports.

The monitoring results provide reliable evidence that the authorized limits are not exceeded. In the period form 2016 to 2021, the highest annual effective dose of the representative person from discharges at the Dukovany NPP into the air was 0.038 µSv, into surface waters 3.71 µSv; at the Temelín NPP from discharges into the air 0.021 µSv, into surface waters 0.75 µSv.

15.3.4 Radiation situation monitoring in the vicinity of a nuclear installation

The obligation to monitor the vicinity of category IV workplace set down by legislation is fulfilled by the operator of nuclear power plants under the Surroundings Monitoring Program approved by the SÚJB. The Monitoring Program sets down the scope, frequency and the methods of measurement and evaluation of the results and the appropriate monitoring levels. The operator performs monitoring through its specialized units and laboratories.

Monitoring of external exposure in the vicinity of the NPP is ensured by the operator through continuous monitoring of dose rates in the local early detection network by the so-called "teledosimetric system". In the internal ring of the teledosimetric system, there are 27 and 24 monitors placed on the perimetr of the guarded area at the EDU and at the ETE, respectively. The outer ring consists of 24 and 23 monitoring sites in the emergency planning zone of the Dukovany NPP and the Temelín NPP, respectively. Data from these monitors are automatically sent to the national database of monitoring of the results – MonRaS, which is operated by the SÚJB.

For external exposure monitoring in the NPP vicinity, the operator also uses the integral dosimeters – TLDs. Within local networks of TLD around the Dukovany NPP there are 55 detectors and 4 more are within the Radioactive Waste Repository at Dukovany; around the Temelín NPP, there are 42 measuring sites with the TLD. TLDs are evaluated quarterly. Besides, the operator of NPP ensures the mobile monitoring group, which both performs regular quarterly exchange of TLD at the measuring sites and monitors dose rates over the specified routes within the emergency planning zone.

Monitoring environmental samples consist of regular measurements of the samples of surface water from watercourses and water reservoirs (ponds), atmospheric fallout, aerosols and iodine from the air, soil and the food chain.

The results of environmental monitoring of both NPPs demonstrate the negligible environmental impact of discharges of radioactive substances from the workplace. The exception is the discharge of ^{3}H into watercourses, which is traceable along the whole Jihlava River and the Vltava River where it achieves up to several hundreds of Bq/l depending on the river flow in the vicinity of the point of discharge. The NPP operators send information on the results of environmental monitoring to the SÚJB in the quarterly reports.

15.4 Inspection and assessing activity of the SÚJB

The Atomic Act entrusted the execution of the state supervision of the radiation protection to the SÚJB. SÚJB inspectors perform the inspection activities in radiation protection.

The activities of the licence holder of a operation of category IV workplace with a nuclear facility are monitored through the so-called continuous (routine) inspections with monthly inspection reports. Based on daily information received from the NPP, inspectors monitor all the relevant information on effective doses of exposed workers, on exceeding of the monitoring levels (both investigation and intervention), and on the events that occurred in the installation. This daily information is supplemented by monthly reports (Report on radiation situation and the level of radiation protection at NPP), where the results of monitoring of individual doses of exposed workers (NPP staff and external workers), the results of monitoring of discharges from the workplace and the results of radiation situation monitoring in the workplace are given. The report provides an overview of exceeding of the monitoring levels with the results of the investigation of their causes and an overview of other unusual events. Furthermore, the NPP operator sends quarterly reports, which summarize in detail the results of monitoring of discharges from the workplace and monitoring of its vicinity.

Another routine inspection is the inspection of radiation protection during refuelling outage. The range of the monitored parameters is similar to the continuous inspection, but the inspection is focused on the unit shut down and the activities performed thereon. It also includes more frequent on-site inspections.

In addition to routine inspections, the SÚJB performs regular specialized inspections. These include, for example, inspections of compliance with the monitoring programs, inspection of radiation protection in activities at individual workplaces within NPP, etc.

The SÚJB ensures its own independent monitoring of discharges and vicinity of the workplace. The NPP operator submits part of the samples taken directly to SÚRO laboratories for analysis. In the case of radioactive substances discharged into the air, part of the aerosol filter is submitted every week, for other items (iodine, ^{3}H and ^{14}C), the part of the weekly sample taken by the operator of the NPP, which is randomly determined by the SÚJB inspector (usually in the outage period), is submitted. The sample of noble gases is taken once at the beginning of the outage. Regarding discharges into watercourses, blended samples collected monthly from control tanks by the operator of the NPP and weekly or biweekly proportionally taken test samples of water discharged into the sewer are submitted to the SÚRO laboratories. The ^{3}H and the activation and fissile radionuclides are determined in these samples.

In the vicinity of both NPPs, the SÚJB operates its own local TLD network (a total of 22 measuring points) and in each emergency planning zone, it has two measuring points for continuous dose rate monitoring in the early detection network with online transfer of the measurement results into the MonRaS database. In addition, the SÚJB has its own mobile monitoring groups. Monitoring of samples of the environment and food chain ensured by the SÚJB is fully independent of the NPP operators and is newly governed by the National Monitoring Program, which came into force on January 1, 2019.

As part of regular inspections of compliance with the Discharge Monitoring Program and the Surroundings Monitoring Program, the SÚJB compares the results of monitoring performed by the operator and independent monitoring. The results have not found show any significant deviations.

Statement on the implementation of the obligations concerning Article 15 of the Convention

The requirements of Article 15 of the Convention are fulfilled in the Czech Republic, both in respect to legislation and implementation.

16. EMERGENCY PREPAREDNESS

(i) *Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency. For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body*.

(ii) *Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with the appropriate information for emergency planning and response.*

(iii) *Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.*

16.1 Radiation extraordinary event management

16.1.1 Overview of the arrangements and requirements of the regulatory body in the field of radiation extraordinary event management

Applicable legislation is in compliance with the documents issued by the European Commission and with the international standards issued by the IAEA.

The legal framework for the field of radiation extraordinary event management consists of the Atomic Act and its implementing decrees (see Chapter 7).

The field of emergency preparedness newly regulates a system of radiation extraordinary event management and is in conformity with the crisis management system in the Czech Republic, while respecting special rules necessary for the field of radiation extraordinary events.

Radiation extraordinary event management is defined by individual phases that are part of this process. This is the system of procedures and measures to ensure:

1. analysis and evaluation of impacts of potential radiation extraordinary event which means; analysis of radiation extraordinary events coming into consideration and evaluating their impacts,
2. radiation extraordinary event response preparedness,
3. radiation extraordinary event response, and
4. remedial action after a radiation accident;

with radiation extraordinary event being understood as an event that leads or may lead to exceeding of exposure dose limits and requires actions to prevent the exceeding of the limits or deterioration of the situation from the standpoint of radiation protection assurance.

International requirements and recommendations were taken into account in the Atomic Act, which have been made more stringent or at least clarified in many cases in the last 18 years. Last but not least, the Atomic Act made full use of the experience hitherto gathered in this field during inspections of emergency preparedness and during emergency exercises. Details are set out in Decree No. 359/2016 Coll., on details of ensuring radiation extraordinary event management.

The provision of Section 4 of the Atomic Act defines the basic terms – radiation extraordinary event, radiation extraordinary event management, first degree radiation extraordinary event, radiation incident, radiation accident, emergency planning zone, and National Radiation Emergency Plan.

Among other things, Section 104 of the Atomic Act establishes the principles for limiting emergency exposure. The principles for averting or reducing exposure due to emergency exposure situations and exposure of people who participate in the mitigating interventions are elaborated in implementing Decree No. 422/2016 Coll. on radiation protection security of a radioactive source.

Section 156 of the Atomic Act imposes, besides general obligations, the obligation upon the holders of a licence to ensure radiation extraordinary event response preparedness including its verification to the extent appropriate to individual licences.

The provisions of Section 154 of the Atomic Act establishes, besides other obligations, the obligation of the holders of a licence to:

- draw up a radiation extraordinary event analysis and evaluation;
- on the basis of the results of the radiation extraordinary event analysis and evaluation, determine the category of the radiation extraordinary event that may arise while performing the licensed activity;
- on the basis of the results of the radiation extraordinary event analysis and evaluation, determine the threat category;
- report the threat category to the person drawing up the off-site emergency plan and the national radiation emergency plan, and
- take into account the results of the radiation extraordinary event analysis and evaluation when drawing up the documentation for the licensed activity.

The provisions of Section 155 of the Atomic Act imposes upon the holders of a licence the obligation to ensure education and training for radiation extraordinary event response and preparation for:

- the detection of radiation extraordinary events;
- the categorization of radiation extraordinary events that have arisen in categories;
- the declaration of a radiation extraordinary event and notification of the authorities concerned;
- the management and implementation of response to radiation extraordinary events;
- the restriction of accidental exposure;
- health matters;
- the provision of preliminary information to the general public;
- the checking of radiation extraordinary event response preparedness;
- the receipt of external assistance, and
- the documentation of radiation extraordinary event response preparedness, including the drawing up of on-site emergency plans, off-site emergency plans and the National Radiation Emergency Plan, as well as emergency rules.

Pursuant to Section 156 of the Atomic Act, the licence holders shall:

- immediately familiarise all persons concerned with the approved on-site emergency plan, including persons operating a facility or installation that may be influenced or affected by a radiation extraordinary event arisen in the course of the activities for which the licence has been granted to the licence holder and persons designated in the on-site emergency plan to respond to radiation extraordinary events;

- immediately familiarise the natural persons concerned with the intervention instructions drawn up;
- immediately familiarise all persons designated in emergency rules to ensure transportation natural persons designated to perform response action with the approved emergency rules;
- share information necessary for the management and implementation of response to a radiation extraordinary event arisen in the context of the licensed activity with neighbouring persons, if they are also holders of a licence under this Act;
- provide for a system of education on radiation extraordinary event management for the natural persons concerned with the intervention instructions, the on-site emergency plan or emergency rules;
- regularly check radiation extraordinary event response preparedness by means of drills, emergency exercises and verification of the functionality of technical means in accordance with the on-site emergency plan, intervention instructions and emergency rules; the checking of radiation extraordinary event response preparedness shall be conducted on the basis of an annual plan and evaluated;
- ensure compliance of the quantities and parameters monitored under their programs for the monitoring of discharges and programs for the monitoring of the surrounding areas with the monitoring levels set out in the on-site emergency plan.

Furthermore, the Section establishes that the licence holders for the performance of activities related to the use of nuclear energy and for the performance of activities in exposure situations, for which an emergency planning zone has been established, shall:

- cooperate with State and territorial authorities and with the intervention units of the integrated rescue system to ensure radiation extraordinary event response preparedness in the case of a radiation accident in the emergency planning zone;
- provide supporting documents for the drawing up of the off-site emergency plan, to the Fire Rescue Service of the Czech Republic and regional authorities;
- provide supporting documents for the drawing up of the national radiation emergency plan, to the SÚJB and the Ministry of the Interior;
- provide for radiation situation monitoring systems at the nuclear installation grounds and in the emergency planning zone and take part in radiation situation monitoring in the territory of the Czech Republic;
- in cooperation with the competent regional Authority or the Fire Rescue Service of the Czech Republic, ensure that the general public and the integrated rescue system units intervening to radiation accidents in the emergency planning zone are provided with iodine prophylaxis antidotes;
- provide basic information to the general public in the emergency planning zone for the case of a radiation accident and update it regularly; basic information for the case of a radiation accident may only be provided or updated on the basis of an affirmative statement of the SÚJB, Fire Rescue Service of the Czech Republic and the governor of the region;
- provide for a system of notification of the authorities concerned;
- acquire, maintain and operate warning system terminals in the emergency planning zone;
- verify, by means of exercises and tactical exercises in cooperation with the competent public administration authorities and integrated rescue system units, the accuracy, efficiency and mutual consistency between on-site and off-site emergency plans and their consistency with the national radiation emergency plan;
- participate in the evaluation of the exercises and tactical exercises as mentioned above and, on the basis of the results of the evaluation, take measures to remedy the deficiencies found;

- immediately inform the SÚJB of the provision of supporting documents for the drawing up of the off-site emergency plan to regional authorities and the Fire Rescue Services of the Czech Republic and of their content, and
- draw up an annual report on radiation extraordinary events response preparedness in the course of the activities performed by the licence holder and submit it to the SÚJB by 31 January of the following calendar year.

Pursuant to Section 157, the licence holders shall ensure a response to a radiation extraordinary event that has arisen in the course of the activities performed by them, in accordance with the relevant on-site emergency plan, emergency rules or, if the on-site emergency plan is not drawn up, intervention instructions, specifically:

- if the maximum monitoring level has been exceeded, immediately initiate a response to the radiation extraordinary event and record the course of the response to the radiation extraordinary event;
- immediately warn natural persons present at the nuclear installation grounds or in the premises of the workplace using an ionising radiation source, take measures to protect them and inform the SÚJB of these measures, and, in the case of a radiation incident involving a suspected release of radioactive substances or ionising radiation out of the nuclear installation grounds or premises of the workplace using an ionising radiation source, or in the case of a radiation accident, also inform other authorities concerned and the persons specified in the on-site emergency plan or emergency rules (in the case of a radiation accident, the warning shall include a proposal for taking urgent protective actions);
- immediately notify the SÚJB about the occurrence or suspected occurrence of a radiation extraordinary event and, in the case of a radiation incident involving a suspected release of radioactive substances or ionising radiation out of the nuclear installation grounds or premises of the workplace with ionising radiation sources, or in the case of a radiation accident, also immediately inform the locally competent mayors of municipalities with extended authorities and the locally competent governor of the region through the territorially competent operations and information centre of the Fire Rescue Service of the Czech Republic, other authorities concerned as specified in the on-site emergency plan or emergency rules, and the neighbouring persons;
- in the case of the occurrence or suspected occurrence of a radiation accident, in cooperation with the Fire Rescue Service of the Czech Republic, immediately start warning the general public in the emergency planning zone and ensure the immediate broadcast of the emergency information (the information shall include the instruction to take urgent protective action in the form of sheltering and application of iodine prophylaxis);
- control, evaluate and regulate the exposure of natural persons participating in radiation extraordinary event response at the nuclear installation grounds or in the premises of the workplace using an ionising radiation source;
- propose to the governor of the region the taking of urgent measures to protect the general public in the emergency planning zone in the form of evacuation according to the actual or expected development of the radiation accident and according to the results of radiation situation monitoring;
- transmit to the SÚJB data to evaluate the radiation accident and forecast its development, including data on the meteorological situation in the site of the radiation accident;
- in the case of a radiation incident or radiation accident, inform the SÚJB and, in the case of a radiation incident or radiation accident involving a suspected release of radioactive substances or ionising radiation out of the nuclear installation grounds or the premises of the workplace with ionising radiation sources, inform the Fire Rescue Service of the Czech Republic and other

authorities and persons concerned as specified in the on-site emergency plan or emergency rules about the actions taken by them in the course of responding to the radiation extraordinary event;

- in the case of a radiation accident, immediately inform the general public affected by this radiation accident about the facts and expected development of the radiation accident;
- if a radiation incident or radiation accident is suspected, ensure radiation situation monitoring in the emergency planning zone in accordance with the relevant monitoring program and the relevant instructions from the SÚJB given in response to the development of the exposure situation, and transmit the data obtained from the monitoring to the SÚJB;
- ensure elimination of the consequences of a radiation incident at a nuclear installation grounds or in the premises of a workplace using an ionising radiation source;
- compile the record of the course of the radiation extraordinary event response into a report on the occurrence and development of the radiation extraordinary event and forward this report to the SÚJB within three months of declaration in the case of radiation accidents or one month of declaration in the case of other radiation extraordinary events;
- keep and retain the record of the course of the radiation extraordinary event response and the report on the occurrence and development of the radiation extraordinary event for a period of at least five years from declaration in the case of radiation extraordinary events or for a period of 30 years from declaration in the case of radiation accidents, and
- cooperate in the preparation of remedial action after a radiation accident in the area affected by the radiation accident.

Furthermore, pursuant to Section 209 of the Atomic Act, the SÚJB shall:

- ensure and conduct drills and emergency exercises for radiation extraordinary event response;
- in cooperation with the Ministry of the Interior, draw up the national radiation emergency plan for threat categories A, B, D and E in accordance with Section 153(1) of the Atomic Act;
- provide preliminary information to the general public for the event of a radiation accident, concerning protective measures and steps that need to be taken to ensure radiation protection; the preliminary information provided shall be up-to-date and constantly available and it shall be provided automatically and repeatedly, at regular intervals and whenever a significant change occurs;
- issue proposals for urgent protective actions or follow-up protective actions, in accordance with the national radiation emergency plan and on the basis of the results of the radiation situation monitoring carried out, or to further specify or withdraw the action and to confirm or further specify proposals for the introduction of urgent protective action issued by licence holders;
- ensure information of the general public about the occurrence and the course of a radiation accident which has an impact on the territory of the Czech Republic outside an emergency planning zone and about the steps and measures to be taken during the various stages of development of the radiation accident, unless this information is being provided by another administrative Authority;
- participate, within the scope of its competence, in the provision of information about the occurrence and the course of a radiation accident within an emergency planning zone;
- ensure that the competent regulatory authorities of neighbouring Member States of the Euratom are notified of the occurrence and the course of a radiation accident which has an impact on the territory of the Czech Republic and about the steps and measures to be taken during the various stages of development of the radiation extraordinary event;

- ensure that an international peer review is invited immediately in the case of a radiation accident that has occurred in the territory of the Czech Republic and led to the implementation of protective measures outside a nuclear installation grounds;
- provide information about the adoption of measures to protect the general public in the Czech Republic in the event of a radiation accident arisen in the territory of Member States of the Euratom to the European Commission and other Member States of the Euratom which may be affected by these measures and, in accordance with the Czech Republic's international commitments, provide public access to information thus obtained;
- ensure notification of regional authorities about the occurrence and the course of a radiation accident outside the territory of the Czech Republic and about the steps and measures to be taken in the course of the radiation extraordinary event.

The details and requirements in the field of extraordinary event management are set out in implementing regulations to the Atomic Act:

- ***Decree No. 359/2016 Coll.,*** on details of ensuring radiation extraordinary event management.
- ***Decree No. 422/2016 Coll.,*** on radiation protection and security of a radioactive source.

Decree No. 359/2016 Coll., sets out details of ensuring preparedness to respond to radiation extraordinary event, in particular:

- the classification rules of a nuclear installation, workplace with ionising radiation sources or activities in exposure situations into the threat category;
- the detailed rules for performing analysis and evaluation of radiation extraordinary event;
- procedures and arrangements to ensure preparedness for response to radiation extraordinary event;
- the method and frequency of the verification of on-site emergency plan, National Radiation Emergency Plan, intervention instruction and emergency rules, and the functionality of technical means;
- the method and frequency of the verification of the efficiency and consistency of the on-site emergency plan, off-site emergency plan and the National Radiation Emergency Plan;
- the content of the annual report on ensuring response preparedness;
- the requirements for ensuring response preparedness in the emergency planning zone and the requirements for the establishment of emergency planning zone;
- the rules for providing the public with antidotes for iodine prophylaxis;
- the rules for ensuring response;
- the scope and way for performing the remedial action after a radiation accident;
- the requirements for the content of the National Radiation Emergency Plan and the scope and method of exercise under the National Radiation Emergency Plan;
- the detailed requirements for the content of the documentation relating to the ensuring of radiation extraordinary event management for the licensed activity and the content of intervention instruction;
- the content of prior general information for radiation accident, the form of provision, scope and method of updating such information, and the way of determining changes influencing radiation extraordinary event management;
- a list of changes related to radiation extraordinary event management at workplace with ionising radiation source, the scope and way of documenting the change related to radiation extraordinary event management, and the procedure and period for notification of such change to the SÚJB; and

- a list of quantities and facts important in terms of radiation extraordinary event management, their scope, method and period of monitoring, measurement, evaluation, verification and recording, the period of retention of information concerning them, the scope, method and period for transmission of information to the SÚJB concerning the quantities and facts important in terms of radiation extraordinary event management.

The provisions of Section 106 of **Decree No. 422/2016 Coll.**, define reference levels for the exposure of an individual in an emergency exposure situation. The provisions of Section 107 set out criteria for the implementation of urgent protective measures in emergency exposure situations and Annex 29 specifies the amount of absorbed dose in the whole body or individual organs above which urgent protective measures must be implemented immediately.

Further requirements are laid down by Act No. 239/2000 Coll., on the Integrated Rescue System and on amendments to some acts, as amended and by Act No. 240/2000 Coll., on Crisis Management and on amendments to some acts (Crisis Act), as amended.

Act No. 239/2000 Coll., on Integrated Rescue System and on amendment to certain acts, as amended, establishes as follows:

- defines the Integrated Rescue System, establishes the units of the Integrated Rescue System and their competences and authorities of state bodies and municipal bodies, rights and duties of legal and natural entities during the preparation for extraordinary events and during rescue and remedial work and during the population protection before and during the declaration of a state of danger, state of emergency, state threatening to the country and state of war;
- in the provisions of Section 2, defines an extraordinary event, which is not identical (is broader) with the term "radiation extraordinary event";
- in the provisions of Section 18, defines communication between the units of the Integrated Rescue System.

Act No. 240/2000 Coll., on Crisis Management and on amendment to certain acts (Crisis Act), as amended:

- stipulates the competencies and authorities of government bodies and authorities of regional self-government units as well as the rights and duties of legal entities and natural persons in preparation for crisis situations not related to assurance of protection of the Czech Republic against external attack and in their solution and during the protection of critical infrastructure and responsibility for the breach of such obligations,
- incorporates the relevant regulations of the EU and regulates the determination and protection of the European critical infrastructure.

Implementing legal regulations were added to the above-mentioned acts, which are, among others, related to emergency preparedness assurance and crisis management in the field of utilization of nuclear energy and ionising radiation. The relevant details are governed by:

- ***Ministry of Interior Decree No. 328/2001 Coll.,*** on some details in ensuring of the integrated rescue system, as amended.
- ***Ministry of Interior Decree No. 380/2002 Coll.,*** for the preparation and performance of tasks for population protection.
- ***Government Order No. 462/2000 Coll.,*** for the implementation of Section 27(8) and Section 28(5) of Act No. 240/2000 Coll., as amended.
- ***Government Order No. 432/2010 Coll.,*** on criteria for defining critical infrastructure elements, as amended.

Ministry of Interior Decree No. 328/2001 Coll., as amended, establishes details for ensuring integrated rescue system operation, including principles for coordination and collaboration of its units during common intervention. The Decree further establishes requirements for the contents of documentation of the integrated rescue system, way of elaboration of documentation and details on alarm degrees of the alarm plan. The Decree also establishes principles and way of elaboration, approval and use of regional emergency plan and off-site emergency plan, as well as the principles of crisis communication and connection within the integrated rescue system.

Ministry of Interior Decree No. 380/2002 Coll., establishes, among others, details in the manner of informing legal and natural persons on the nature of the possible threat, upcoming measures and the way of their implementation, details of technical, operational and organizational plans ensuring a unified warning and notification system and a way of providing emergency information as well as details of evacuation and its comprehensive security.

Government Order No. 462/2000 Coll., establishes in particular details of identification, recording, handling and filing of documents and other materials containing special facts, and procedure for designation of persons to contact with special facts; the content of activity and composition of the Regional Crisis Staff and specified municipality with extended competences; details and method of preparing of the crisis plan, details and method of preparing the crisis preparedness plan, and details and method of preparing the crisis preparedness plan of a critical infrastructure entity.

16.1.2 Overview and implementation of the main elements of radiation extraordinary event management including procedural roles and responsibilities of the licence holder, regulatory body and other main actors, including central administrative authorities

In accordance with the legal regulations, in particular in the area of crisis management, a structure of the crisis preparedness system was established in the Czech Republic for the case of crises of different types. Fig. 16-1 shows the basic diagram of the structure of the crisis preparedness system for the case of a radiation accident.

In case of a radiation accident occurrence in the Czech Republic or abroad with a possible impact on the Czech Republic territory, the occurring crisis situation is being solved within the crisis (emergency) response system, the basic diagram of which is given in Fig. 16-2.

Fig. 16-1 Basic diagram of the Czech Republic emergency preparedness structure for the event of a radiation accident

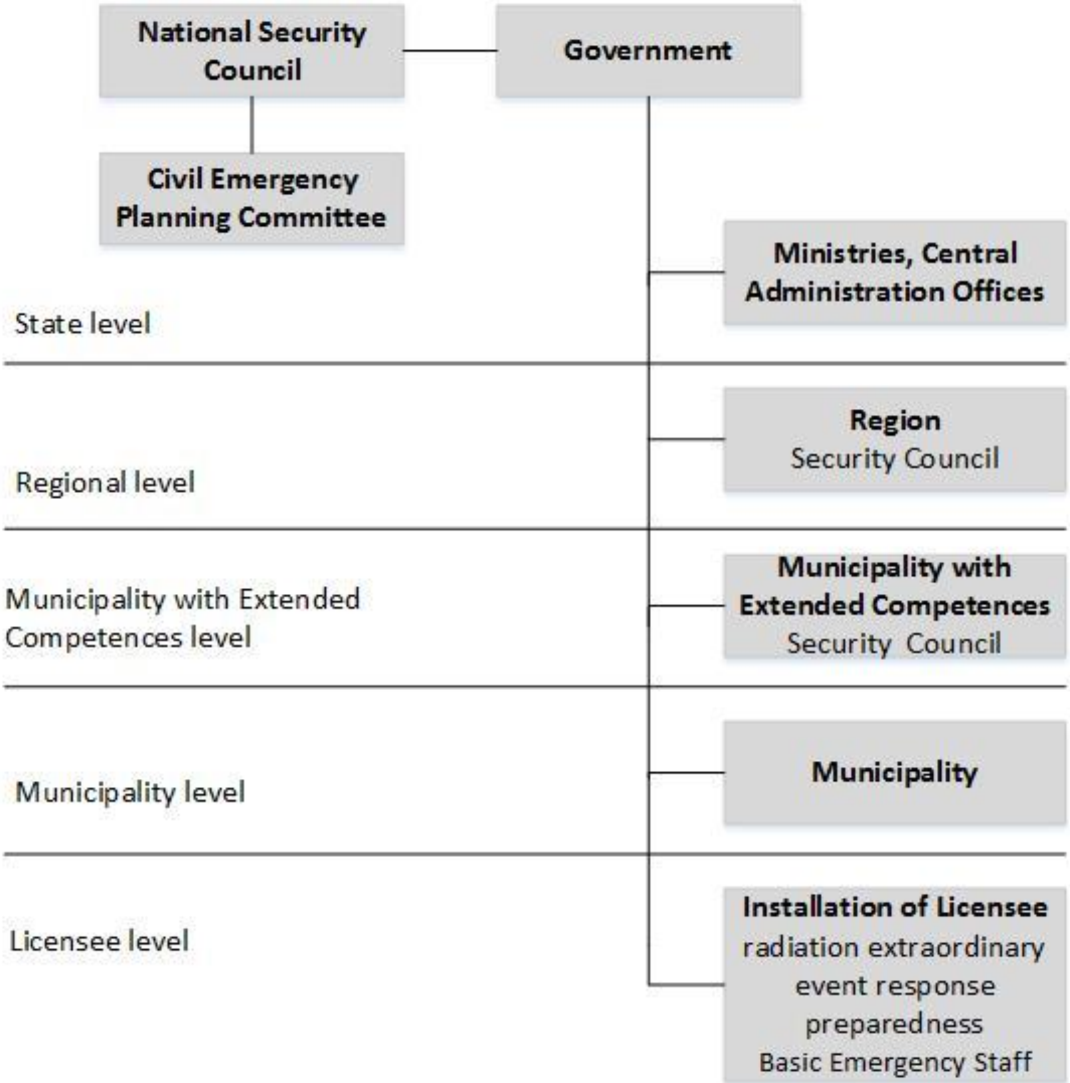
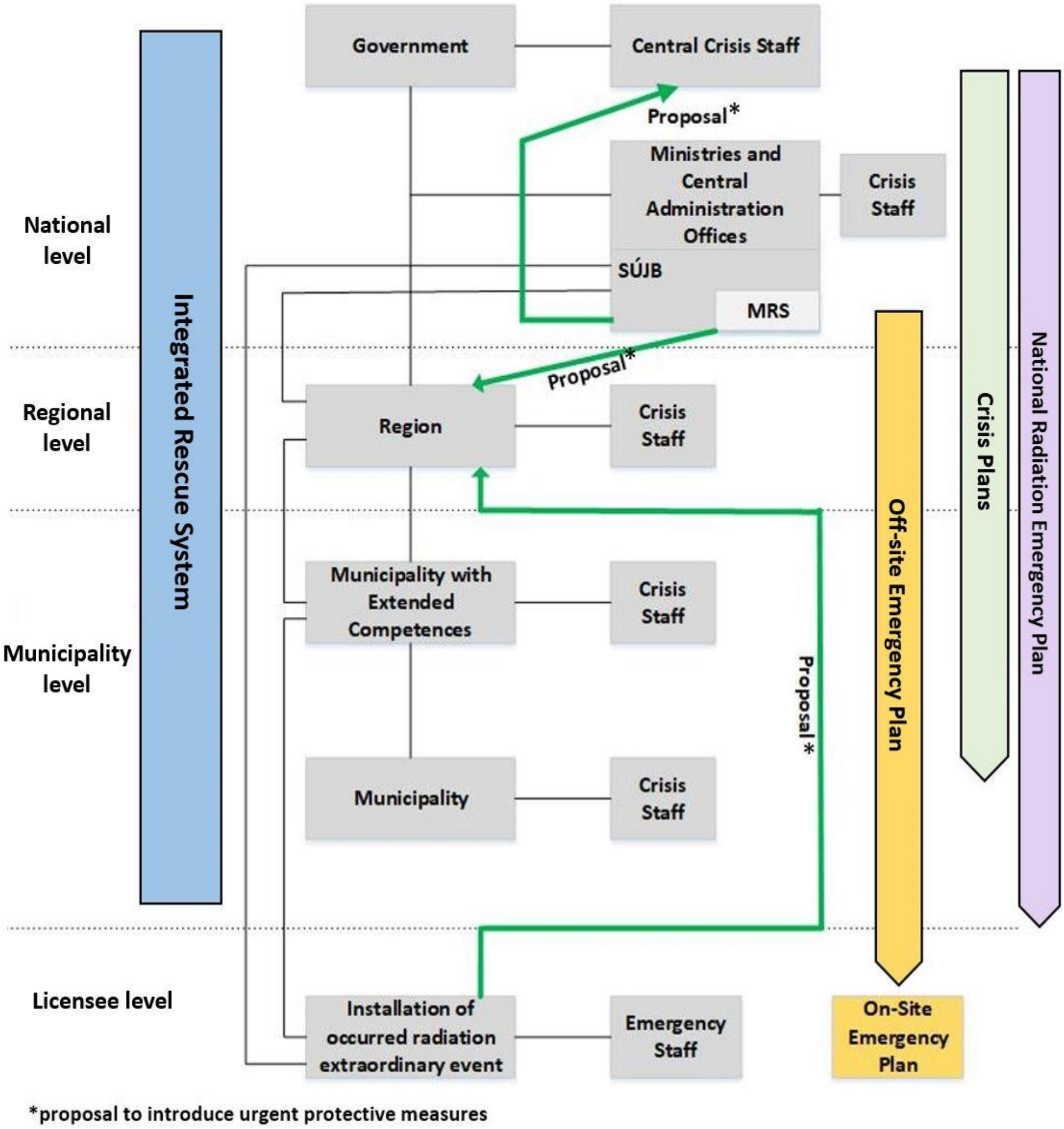


Fig. 16-2 Basic diagram of the Czech Republic crisis response structure for the event of a radiation accident



The Czech Republic government is the supreme body responsible for the crisis situations preparedness and in case of their occurrence for their solution in the territory of the Czech Republic. As a standing working body of the government to coordinate the safety-related problems of the Czech Republic and prepare draft measures to assure it, the constitutional Act No. 110/1998 Coll., on the Czech Republic Security, as amended by Act No. 300/2000 Coll., established the National Security Council. The composition and activities of the National Security Council are further specified by Government Resolution of July 9, 2014, No. 544 on the Statute of the National Security Council and the statutes of the standing working committees of the National Security Council; Government Resolution of May 10, 2017, No. 360 on the proposal for the establishment of the Committee for Cyber Security of the National Security Council; Government Resolution of April 18, 2018, No. 247 on the proposal for changes to the statutes of the National Security Council and its standing working committees; Government Resolution of July 10, 2018, No. 457 on the proposal for changes to the statutes of the National Security Council and its standing working committees, and Government Resolution of October 24, 2018 No. 692 on the proposal for changes to the statutes of the National Security Council and its standing working committees, and Government Resolution of December 22, 2021, No. 1187 on the composition of the National Security Council. Czech Government Resolution No. 544, of July 9, 2014, on the Statute of the National Security Council and on statutes of standing working committees of the National Security Council specified its main tasks in the area of crisis preparedness and crisis situations management. The activity of the National Security Council follows the statute and the rules of procedure.

The standing working body of the National Security Council for civil emergency planning and for coordination and planning of measures to provide internal security of the State is the Civil Emergency Planning Committee (VCNP). The VCNP coordinates the above issue aimed at planning the measures to protect the population and economy, to protect the critical infrastructure including measures for the case of a radiation accident, preventive measures against the use of weapons of mass destruction including the elimination of the consequences of their use and the harmonisation of the requirements for material sources necessary for ensuring the security of the Czech Republic.

In the course of 2015, strategic document “Analysis of Threats for the Czech Republic” was drawn up, which was approved by Resolution No. 369 of the Government of the Czech Republic on 27 April 2016. On the basis of the results of this analysis, the threat of radiation accident is still regarded as potential crisis situation and measures continue to be adopted to eliminate the risk of its occurrence and to reduce potential impacts, including update of the relevant safety-related documentation. Following the identification of critical situations in the Threat Analysis, the type plans have been updated for their solution, including type plan for radiation accident. A new Type plan for radiation accident was approved by the SÚJB Chairperson in September 2018.

Issues in the area of planning and preparedness for the case of radiation accident occurrence come within the competence of the VCNP and the areas of radiation accident solution within the competence of the Central Crisis Staff, which acts as a government working body for the crisis situations management.

The main tasks in the area of the VCNP competence are specified by the VCNP Statute and especially focused on the following:

- coordination of planning of the measures for assurance of protection of the population and economy, protection of the critical infrastructure including assurance of the protective measures in case of radiation accident,
- preventive measures against the use of mass destruction weapons including a solution to elimination of consequences of their use and harmonization of the requirements for material sources necessary for assurance of security of the Czech Republic,
- assessment and discussion of the intentions of preparatory, planning and conceptual measures and activities,

- assurance of operative inter-branch coordination of preparatory, planning and conceptual measures and activities,
- evaluation of implementation of preparatory, planning and conceptual measures and activities as well as the proposals for implementation of necessary preventive measures,
- assessment, discussion and coordination of activities of the representatives of the Czech Republic in the bodies of EU, North Atlantic Treaty Organization (NATO) and other international entities,
- discussion of the Plan of formation and maintenance of state material reserves for assurance of security of the Czech Republic,
- coordination of the implementation of security research of the Czech Republic.

The Minister of Interior is the Chairperson of the VCNP; the Deputy Minister of Interior is the Executive Deputy Chairperson and the deputy ministers of 12 departments, the SÚJB Chairperson, the member of the bank council of the Czech National Bank, the Chairperson of the Administration of State Material Reserves, the Director of the National Security Authority, the Director of the National Cyber and Information Security Agency, the Director of the Secretariat of the National Security Council, the Chairperson of the Council of Czech Telecommunication Office, the Police President, Chief Executive Officer of Fire Rescue Service of the Czech Republic, representative of the Office of the President of the Czech Republic.

To ensure that the occurred crisis situations including radiation accident at a national level are addressed a working body of the government, the Central Crisis Staff is established with 26 members. Depending on the nature of the crisis situation, the chairman of the Central Crisis Staff is either the Minister of Defence for the case of crisis situations affecting the external military threat of the Czech Republic, fulfilment of alliance commitments abroad and participation of the Czech Armed Forces in foreign operations, or the Minister of the Interior in other situations. The members of the Central Crisis Staff are deputy ministers, the Chairperson of the Administration of State Material Reserves, the Director of the National Cyber and Information Security Agency, the SÚJB Chairperson, the Head of the Office of the Government of the Czech Republic, the Chief Hygienist of the Czech Republic, the Police President of the Czech Republic, the Chief Executive Officer of Fire Rescue Service of the Czech Republic, the Chief of the General Staff of the Czech Armed Forces, the Director of the Czech Hydrometeorological Institute, the representative of the Association of Regions of the Czech Republic, and the Head of the Office of the President of the Czech Republic. The Prime Minister may attend meetings of the Central Crisis Staff. In this case, he/she becomes the Chairman of the Central Crisis Staff. The Central Crisis Staff may invite representatives of other ministries, other administrative authorities, authorities of regional self-government units and other experts to its meetings. The decision to invite them is taken by the Chairman of the Central Crisis Staff.

The Central Crisis Staff, after declaring a state of emergency, state of threat or state of war, as well as in the event of a threat of crisis situation, or in other serious situations concerning the security interests of the Czech Republic, prepares proposals to deal with these situations. The Central Crisis Staff can be activated both in case of radiation accidents of a nuclear installation outside the Czech Republic territory with the possibility of impact on the Czech Republic, and during radiation accidents occurring during the transport of nuclear materials and radioactive substances.

The role of the Czech Government, central administrative authorities and other state administration authorities in the field of radiation extraordinary event management is specified in Sections 210 to 225 of the Atomic Act. According to these sections, the following was set out:

- The Czech Government approves the National Radiation Emergency Plan.
- Ministries and other administrative authorities submit inputs to the SÚJB and the Ministry of Interior to develop or update the National Radiation Emergency Plan, and its approval, they practice and act according to the National Radiation Emergency Plan.

- The Ministry of Interior cooperates with the SÚJB in developing the National Radiation Emergency Plan.
- The Ministry of Health develops the system of special medical care provided by selected clinics to natural persons irradiated during radiation extraordinary event.
- The Ministry of Defence, the Ministry of Agriculture, the Ministry of the Environment, the Police of the Czech Republic, the Customs Authorities of the Czech Republic, the State Agriculture and Food Inspection, and the Fire Rescue Service of the Czech Republic are involved in radiation situation monitoring, including monitoring along monitoring routes and locations.
- In the scope of its competence, the Fire Rescue Service of the Czech Republic provides preliminary informing to the general public about the measures to protect the general public, which apply to the general public and about the steps to be taken in the case of such situation. In the case of a radiation incident or radiation accident, it informs, in the scope of its competence, the general public affected by this radiation extraordinary event. It develops the off-site emergency plan for the specified emergency planning zone around the nuclear installation. In conjunction with the licence holder and the competent Regional Office, it cooperates in providing the public in the emergency planning zone with antidotes for iodine prophylaxis.
- In the scope of its competence, the competent Regional Office provides preliminary informing to the general public about the measures to protect the general public, which apply to the general public and about the steps to be taken in the case of such situation. In conjunction with the licence holder and the Fire Rescue Service of the Czech Republic, it cooperates in providing the public in the emergency planning zone with antidotes for iodine prophylaxis.
- In the case of radiation incident associated with the suspicion of a possible release of radioactive substances or propagation of ionising radiation from the site of the nuclear installation or a workplace with ionising radiation source or radiation accident occurring in the territory of the region, the governor of the region, in the scope of his/her competence, immediately informs the public affected by this radiation extraordinary event about the facts of radiation incident or radiation accident, the steps to be taken and the measures to protect the public to be taken, if necessary in that case. When informing the public, he/she cooperates with the Fire Rescue Service of the Czech Republic and the municipal authority with extended powers. He/she approves the off-site emergency plan for the emergency planning zone.
- The Ministry of Agriculture ensures the operation of testing laboratory and its participation in comparative measurements.
- The Ministry of the Environment performs monitoring of meteorological situation, forecasts of its development and the way of dispersion of the released radionuclides during the emergency monitoring and ensures the operation of the testing laboratory and its participation in comparative measurements.

16.1.3 Preparedness for response to radiation extraordinary event

16.1.3.1 Categorization of radiation extraordinary events

Radiation extraordinary event means an event that leads or may lead to exceeding of exposure dose limits and requires actions to prevent the exceeding of the limits or deterioration of the situation from the standpoint of radiation protection assurance. To assess significance of radiation extraordinary events, which may occur during the performance of radiation activities on a nuclear installation, these events are divided into three basic categories (Section 4 of the Atomic Act):

a) first degree radiation extraordinary event means a radiation extraordinary event that can be handled by forces and means of the operators or shift personnel of the person whose activities gave rise to the radiation extraordinary event,

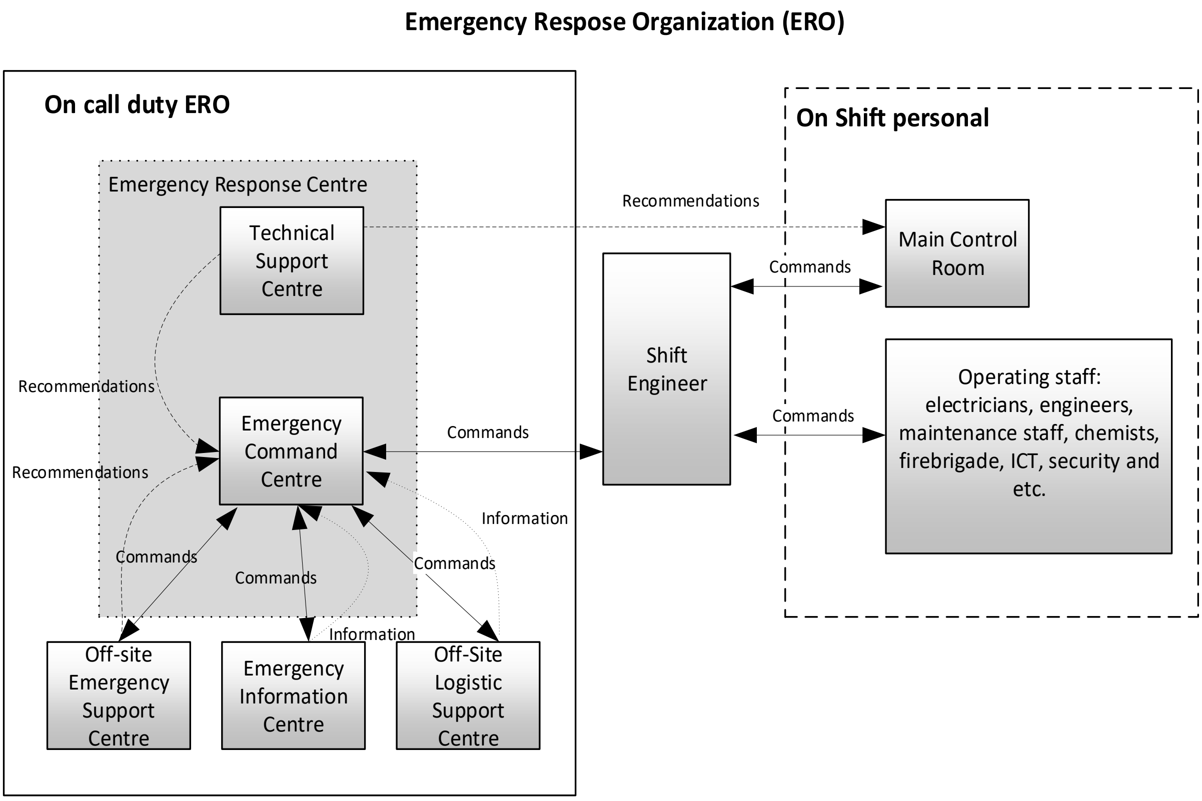
b) radiation incident means a radiation extraordinary event that cannot be handled by forces and means of the operators or shift personnel of the person whose activities gave rise to the radiation extraordinary event or has resulted from the finding, misuse or loss of a radionuclide source which does not require taking urgent action to protect the general public,
c) radiation accident means a radiation extraordinary event that cannot be handled by forces and means of the operators or shift personnel of the person whose activities gave rise to the radiation extraordinary event or has resulted from the finding, misuse or loss of a radionuclide source which requires taking urgent action to protect the general public.

16.1.3.2 Ensuring preparedness for response to radiation extraordinary event at the licence holder

Emergency response organisations (ERO)

Response during the origination of a radiation extraordinary event at NPP is always ensured in the first phase of the development of a radiation extraordinary event by on-shift personnel (IERO – internal emergency response organisation), under the management of the shift engineer. In cases where the event is, by its scope, outside the framework of the capacities of on-shift personnel, IERO is completed by employees who are on call duty within the ERO (On call duty ERO). In this case, the Head of Emergency Command Centre (ECC) takes over responsibility for managing the response after mobilization of ECC from the Shift Engineer.

Fig. 16-3 Structure of the emergency response organisation at Dukovany/Temelín NPP



Internal Emergency Response Organisation (IERO)

The IERO consists solely of shift personnel, i.e. employees, who ensure normal operation of a nuclear installation. The continuous shift personnel ensure all activities according to the instructions from the shift engineer, relating to eliminating any signs of occurring extraordinary event until the activation of employees who are on stand-by duty within the ERO.

Shift Engineer

In case of radiation extraordinary event occurrence, the Shift Engineer is responsible for the management of response until the Shift Engineer transfers the responsibility to the mobilized Head of ECC. The Shift Engineer activities during the radiation extraordinary event occurrence follow the intervention instruction for shift engineer, which includes all responsibilities and competences; the basic responsibilities and competences include: categorization of radiation extraordinary event, notification and warning of the NPP personnel and warning within the emergency planning zone, notification of nuclear power plant management and competent bodies and organizations on event occurrence, decision on the mobilization of the On call duty ERO, decision on protective measures for NPP personnel. Responsibility for managing the technology remains in the competence of the shift engineer.

Operational MCR personnel

The main control room personnel having the basic workplace at the relevant MCR assure the control of each unit in case of a radiation extraordinary event occurrence. In case the MCR is uninhabitable, or in the case of loss of the possibility of control of unit technology, the MCR personnel perform their activities from the stand-by workplace of the MCR. Safety engineer responsible for radiation extraordinary event management on the unit affected by a radiation extraordinary event is transferred to support the personnel of this unit of the Dukovany NPP.

Other shift personnel

Other personnel of shift operation, depending on the degree of announcement of radiation extraordinary event, either continue to perform activities in accordance with the instructions of the shift management personnel, or hide in the shelter (i.e. at the Dukovany NPP in the shelter on building PB II and at Temelín NPP in the shelter under building PB) where, under the guidance of the shift engineer, MCR personnel or Technical Support Centre (TSC) function Intervention Management, they perform the required actions on the technology.

On call duty ERO

Fig. 16-4 Structure of the On call duty ERO at Dukovany NPP

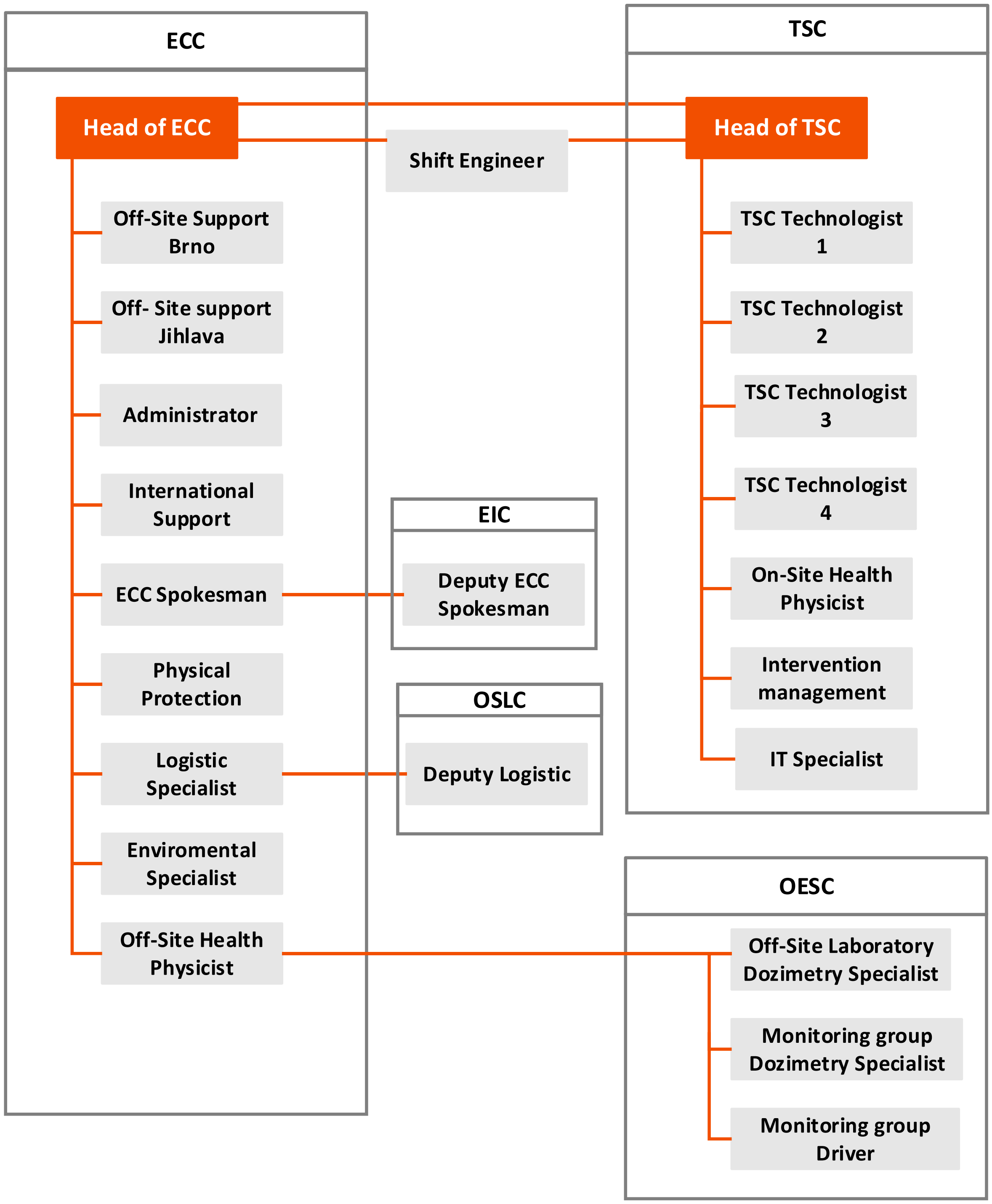
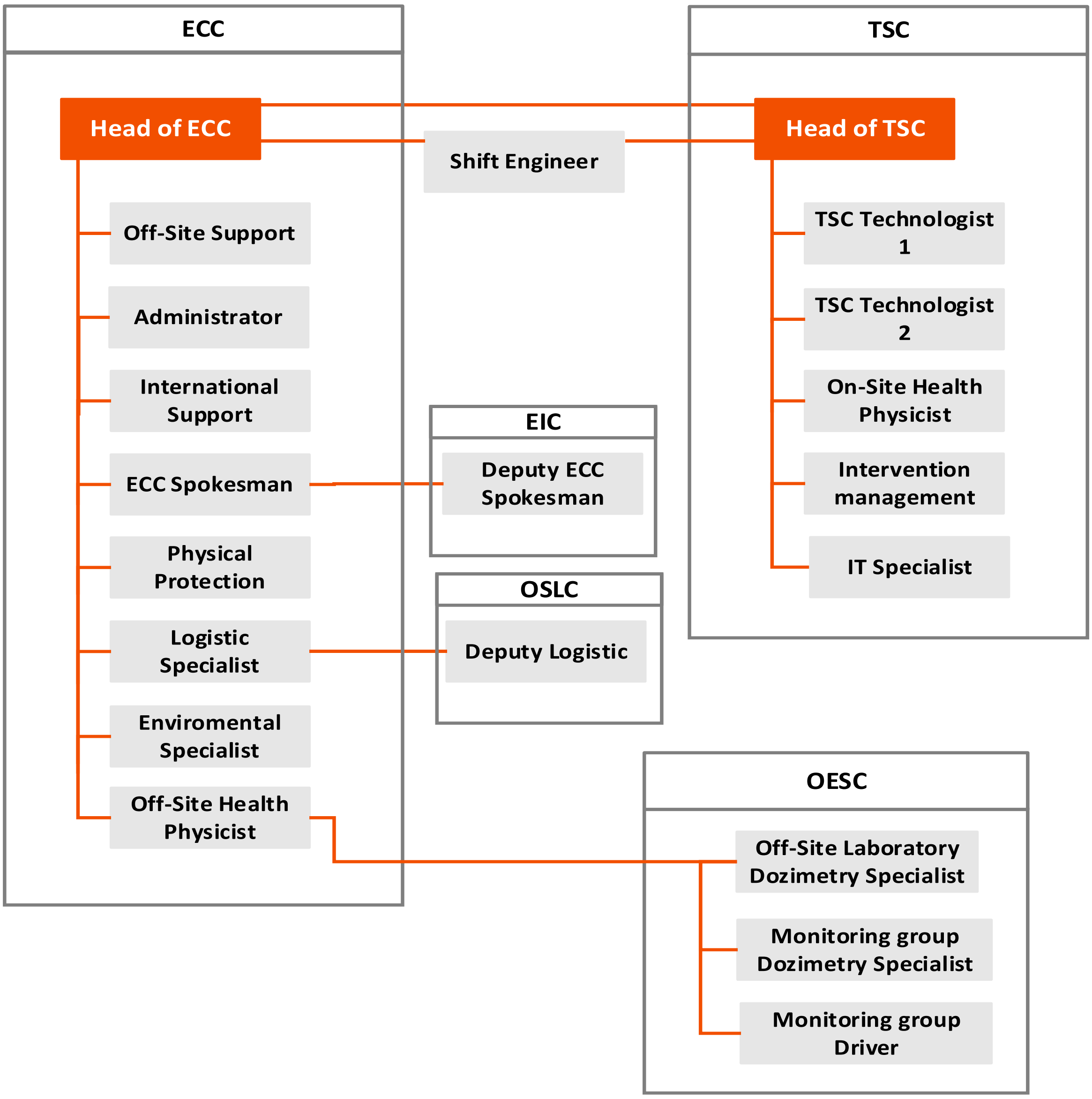


Fig. 16-5 Structure of the On call duty ERO at Temelín NPP



The On call duty ERO is composed of emergency response facilities staff:

Emergency Command Centre (ECC)

ECC personnel provides communication and information transfer to the Crisis Staff of ČEZ, a. s., and regulatory bodies, information to the general public and announcement of protective measures for persons in the area of a nuclear installation during a radiation extraordinary event. In addition, an ECC personnel secures the deliveries of necessary material, special means, and alternating the personnel as well as its maintenance and supplies.

The activities of individual members of the ECC are defined in the On-site Emergency Plan of NPP and in intervention instructions for individual members of the On call duty ERO. The structure of ECC Dukovany is shown in the left part of Fig. 16-4. The structure of ECC Temelín is shown in the left part of Fig. 16-5.

Technical Support Centre (TSC)

Technical Support Centre personnel handles the recommendations for the MCR personnel of the affected unit in dealing with radiation extraordinary events. The TSC personnel also ensures immediate evaluation of nuclear power plant condition in consideration of nuclear safety and radiation protection; has control over the activity of intervention groups in response to radiation extraordinary event; is able to prepare inputs and recommendations for decision-making and internal management activities of the ECC. If required by shift engineer or Head of the ECC, support can be requested for TSC personnel from other specialists. The structure of TSC Dukovany is shown in the right part of Fig. 16-4. The structure of TSC Temelín is shown in the right part of Fig. 16-5.

Off-site Emergency Support Centre (OESC)

Off-site Emergency Support Centre staff is responsible for managing activities related to radiation situation monitoring, evaluation of radiation situation in the emergency planning zone and prepares forecasts for the ECC on the impact of radiation extraordinary event on the population in the emergency planning zone.

Logistics Support Centre (LSC)

Logistics Support Centre personnel provides the necessary material and technical resources and qualified human resources according to the requirements and needs of the ECC. The LSC is the external support of the ERO. The LSC in the Dukovany NPP is mobilized within the High Technical School, Třebíč and the LSC in the Temelín NPP is in the K5 college of the University of South Bohemia in České Budějovice.

Emergency Information Centre (EIC)

Emergency Information Centre staff ensures, in the case of a radiation extraordinary event, the distribution of all information to mass media and the answering of questions from the public. The centre is responsible for preparing press releases for mass media. The EIC in the Dukovany NPP will be mobilized in the Information Centre or the Fire Rescue Service of the South Moravian Region. The EIC in the Temelín NPP will be mobilized in the ECC or OESC or Integrated Press Centre of the South Bohemian Region.

Protection measures in a nuclear installation

In the case of an event important to NPP safety, the shift engineer shall evaluate its severity. According to the assessment of the radiation situation, the state of technology and the expected development of the event, the shift engineer or Head of ECC shall announce individual protective measures for sheltering and assembly, ingestion of iodine prophylaxis and evacuation.

Justified urgent protective measures are:

a) sheltering, if the averted effective dose is greater than 10 mSv for sheltering period lasting no longer than 2 days,
b) iodine prophylaxis, if there is a risk of internal contamination with radioactive iodine,
c) evacuation, if the sum of the effective dose so far received in an emergency exposure situation when taking into account the effect of the already implemented protective measures and the effective dose, which could be averted by evacuation, is greater than 100 mSv over the first 7 days.

Dukovany NPP shelters

For the implementation of urgent protective measures for persons located in the nuclear installation there are seven shelters in the Dukovany NPP.

Shelter No.	Location	Design capacity [persons]
1	PB I	350
2	PB II	350
3	HZSp EDU	150
4	AB1	150
5	Central reception	700
6	Transport	450
7	AB2	300

All seven shelters and both points of assembly are activated and used only in the case of the announcement of sheltering during working hours of non-shift employees on weekdays (Mon-Thu 7:00 a.m. to 3:00 p.m., Fri 7:00 a.m. to 12:30 p.m.). Outside the working hours, when the number of persons present in the area of the Dukovany NPP is low, only shelter no. 2 (PBII) and shelter no. 4 (AB1) are activated.

Shelter no. 2 (PBII) is determined as priority to shelter shift personnel. In case of impossibility of using this shelter, shelter no. 4 (AB1) is determined for sheltering shift personnel.

Temelín NPP shelters

For the implementation of urgent protective measures for persons located in the nuclear installation there are four shelters in the Temelín NPP.

Shelter No.	Location	Design capacity [persons]
1	AB (ECC)	40
2	Workshops	900
3	PB	685
4	Training Centre	150

All four shelters and the points of assembly A and B are activated and used only during working hours (Mon-Wed 7:00 a.m. to 3:00 p.m., Fri 7:00 a.m. to 12:30 p.m.). Outside the working hours, when the number of persons present in the area of the Temelín NPP is low, only shelter no. 1 (AB) and shelter no. 3 (PB) are activated.

Off-site emergency plans of nuclear installations

For Dukovany NPP and Temelín NPP, emergency planning zones were established in response to the proposals for emergency planning zones by the SÚJB decisions, on the basis of the evaluation of the radiation extraordinary events considered and their consequences in terms of nuclear installation technology designed for electricity generation. The emergency planning zones for nuclear installations established by the SÚJB before the effective date of the Atomic Act shall be regarded as the emergency planning zones established under this Act.

The principles and method of development, approval and use of the off-site emergency plan of nuclear installations, including the principles of crisis communication and connection within the integrated rescue system are set out in the Ministry of Interior Decree No. 328/2001 Coll., on some details in ensuring of the integrated rescue system, as amended.

Off-site emergency plan, which is emergency plan prepared for the emergency planning zone, is divided into:

- information section,
- operations section,
- plans of specific activities.

Information section includes:

a) general description of the nuclear installation or workplace of the category IV,
b) characteristics of the territory, in particular data on demography, geography, climatic conditions and description of infrastructure on the territory,
c) list of municipalities, including the overview on the number of population, and list of legal and other responsible persons included in the off-site emergency plan,
d) analyses results of possible radiation accidents, and possible radiological effects on the population, animals and environment,
e) classification system of radiation accidents in accordance with the on-site emergency plan,
f) requirements for the population and environment protection in relation to intervention levels during the radiation accident,
g) description of the emergency preparedness organizational structure in the emergency planning zone, including a listing of competencies of its components for the performance of necessary activities, and
h) description of a notification and warning system, which includes the relations to licensee and information transfer within the emergency preparedness organizations in the emergency planning zone.

Operations section includes:

a) tasks of administration offices, municipalities and components having relation to countermeasures included in the off-site emergency plan,
b) way of radiation accident response coordination,
c) criteria for the declaration of corresponding crisis states, in case the off-site emergency plan is clearly not sufficient to deal with the radiation accident,
d) way of securing information flows during the radiation accident consequences remedial management and
e) principles for activities during the spreading or the possibility of spreading of radiation accident consequences outside the emergency planning zone and cooperation between administration offices and municipalities having relations to countermeasures included in the off-site emergency plan.

Plans of specific activities establish procedures for the implementation of the individual measures for the following areas:

a) notification,

b) warning of the population,
c) rescue and remedial work,
d) sheltering of the population,
e) Iodine prophylaxis,
f) evacuation of persons,
g) individual protection of persons,
h) decontamination,
i) monitoring,
j) regulation of persons movement and transport,
k) traumatologic plan,
l) emergency plan for veterinary measures,
m) regulation of food, feedstuff and water distribution and consumption,
n) measures in case of death of persons in the contaminated area,
o) public order and safety ensuring, and
p) communication with the public and mass information media.

16.1.3.3 National Radiation Emergency Plan

One of the requirements of nuclear legislation is the development of the so-called National Radiation Emergency Plan, which is a plan drawn up for the territory of the Czech Republic outside nuclear installation grounds or category IV workplaces to prepare for the management and implementation of a response to a radiation accident with an impact outside the emergency planning zone and, where appropriate, to a radiation accident which may occur abroad or anywhere in the Czech Republic, including emergency planning zone, and whose management is not dealt with in off-site emergency plans. Such a radiation accident, i.e. radiation extraordinary event, which requires the adoption of measures to protect the population, may be, in addition to an accident in a nuclear installation, an accident in radioactive material transport, explosion of a dirty bomb – i.e. explosives contaminated with radioactive materials, dispersion of radioactive material from an orphan, lost or stolen radionuclide source, etc. These events can only have a local and, to the extent of damage, limited impact on both health and property of persons, which can be managed at the level of one affected region but can also have much more significant impacts to the extent of more than one region, thus affecting even more persons with a potentially serious threat to their health. The method and extent of dealing with such events will always depend on the specific conditions, the amount, form and composition of radioactive materials released into the environment.

Pursuant to Section 209 d) of the Atomic Act, the State Office for Nuclear Safety shall, in cooperation with the Ministry of the Interior, draw up the National Radiation Emergency Plan for threat categories A, B, D and E in accordance with Section 213 of the same Act, and in accordance with Section 4(1) l) for the territory of the Czech Republic outside nuclear installation grounds or category IV workplaces to prepare for the management and implementation of a response to a radiation incident or radiation accident with an impact outside the emergency planning zone. The National Radiation Emergency Plan is developed only for those threat categories for which there is a possibility of radiation accident. The National Radiation Emergency Plan is followed within two years of its approval by the government. The National Radiation Emergency Plan, and thus the preparedness of individual actors to perform the tasks assigned to them for threat category A, must be regularly verified in the form of exercises at least once every four years with a link to the off-site emergency plans. The National Radiation Emergency Plan exercise for other threat categories will be conducted as the need arises.

The National Radiation Emergency Plan is divided into:

- A Introductory part,

- B Follow-up protective actions,
- C Annexes.

The introductory part contains:

a) A.1 List of emergency planning zones.
b) A.2 List of the areas taken into account where the threat category E has been identified.
c) A.3 Description of the organisation of crisis management of central authorities.
d) A.4 Overview of administration authorities.
e) A.5 List of competencies of the bodies referred to in point A.4.

Follow-up protective actions part includes:

a) B.1 Strategy for optimised radiation protection for the administration of the contaminated area, the contamination of which is the result of NES.
b) B.2 Symptoms for the transition from an emergency exposure situation to an existing exposure situation.

B.3 Arrangements for prompt coordination of the procedure.

The Annex part contains:

a) C.1 Communication plan.
b) C.2 Digitalised map with indicated emergency planning zones and areas under point A.1.

16.1.4 Training and emergency exercises, evaluation and outputs of performed emergency exercises including lessons learned

The licence holder shall regularly check radiation extraordinary event response preparedness by means of drills, emergency exercises and verification of the functionality of technical means in accordance with the on-site emergency plan, intervention instructions; the verification of radiation extraordinary event response preparedness shall be conducted on the basis of an annual plan and evaluated.

The licence holder for the performance of activities related to the use of nuclear energy and for the performance of activities in exposure situations, for which the emergency planning zone is established, shall verify, among other, accuracy, efficiency and consistency of the on-site emergency plan and the off-site emergency plan through exercise or tactical exercise in cooperation with competent public authorities and the units of the Integrated Rescue System.

Drills and emergency exercises shall be carried out according to the prepared annual plan for verifying the response preparedness, which sets out the specialisation, scope of drill or emergency exercise, and their implementation dates.

Verification of the efficiency and consistency of the on-site emergency plan, off-site emergency plan and the national radiation emergency plan shall be performed through joint practising of the scenario for radiation accident occurred in a nuclear installation or category IV workplace, for which the emergency planning zone is established, once a period of four calendar years and the evaluation of the practice.

The management of radiation extraordinary event in the emergency planning zone is verified by exercises according to the off-site emergency plan in case of a radiation accident. The exercise is prepared by the Regional Office in cooperation with the licensee. Participants in the exercise are the holder of a licence, the Regional Office, the Integrated Rescue System (Fire Rescue Service of the Czech Republic, fire protection units in the coverage of the region with fire protection units, providers of emergency medical services and the Police of the Czech Republic), other bodies and organizations involved in the off-site emergency plan, and the SÚJB.

The Czech Republic participates in international exercises organized by the European Commission (ECURIE), IAEA (Conventional Exercise - ConvEx), OECD-NEA (International Nuclear Emergency Exercise - INEX), NATO (Crisis Management Exercise - CMX), and others, if necessary.

The method and frequency of verification of the emergency plans, intervention instructions and the emergency rules for category IV workplace are set out in Section 16 of Decree No. 359/2016 Coll., on details of ensuring radiation extraordinary event management. Verification must be performed:

- in the form of drill for each intervention instruction, where a radiation extraordinary event of first degree can only occur, once a year;
- in the form of an emergency exercise, including the on-site emergency plan and the intervention instructions, where
    1. a radiation incident can occur, which shall practice all intervention instructions in a period of two consecutive calendar years;
    2. a radiation accident can occur, which shall practice all intervention instructions in a period of three consecutive calendar years, and
- in the form of an emergency exercise, including the emergency rules, unless they are part of the on-site emergency plan, and the selected intervention instructions, once every three years.

The final evaluation of the emergency exercise for a radiation accident shall be submitted to the SÚJB by the licence holder within two months after the end of the exercise. The summary evaluation of all the drills and emergency exercises implemented to verify the response preparedness shall include the evaluation of all the drills and emergency exercises implemented in the calendar year. Where individuals designated for response implementation and management are divided into response shifts, the overview of drills and emergency exercises contains also information on what response shift implemented the drill or the emergency exercise.

Dukovany NPP and Temelín NPP staff designated by the on-site emergency plan to manage and implement responses to radiation extraordinary event is periodically trained in accordance with the requirements of applicable legislation. Every function in the emergency response organization has its own specific plan of theoretical and practical training. The preparedness to respond to a radiation extraordinary event is regularly verified in accordance with the annual plan of verifying the preparedness for response. Under the emergency exercises, the ability of emergency response organization to manage and implement responses to the various stages of a radiation extraordinary event is verified.

16.1.4.1 Cooperation emergency exercises of ČEZ, a. s.

The cooperation emergency exercises together with the Integrated Rescue System units and other bodies defined in the off-site emergency plans described in The Czech Republic National Report of 2016 continued with other exercises.

The cooperation exercise called “Safeguard” took place at the Dukovany NPP from 19 to 23 September 2016. The aim of the exercise was to practically verify the establishment of closures and occupancy of the main access roads (control release sites) by the Armed Forces of the Czech Republic. The set objectives of the exercise have been met.

In 2017:

- The exercise “Safeguard” took place at the Temelín NPP on 10 April 2017. The aim of the exercise was to practically verify the establishment of closures and occupancy of the main access roads (control release sites) by the Armed Forces of the Czech Republic. The set objectives of the exercise have been met.
- The exercise “ZÓNA 2017” took place at the Dukovany NPP from 15 to 16 May 2017. The exercise “ZÓNA” simulated a multi-unit event – loss of coolant accident (LOCA) on Unit 1 and

Long term blackout on Unit 2 – an extraordinary event of third degree. The exercise took place in the staff form and data was transferred to the exercise participants by a moderator. The technological scenario of the exercise was developed externally and was unknown to the participants in the exercise. The second day of the exercise engaged mobile groups for monitoring in the emergency planning zone. The set objectives of the exercise have been met.

- The exercise "TORNÁDO 2017" took place at the Dukovany NPP on 6 June 2017 – the objective was to verify event management using alternative means of NPP and the Integrated Rescue System. The Tornado 2017 was the cooperation topical exercise aimed to mutually introduce new techniques of Fire Rescue Service and techniques in the NPP acquired in the context of stress-tests. During the exercise, dynamic demonstrations in simulated damage to the site were performed – removal of debris by suction, shoring of damaged buildings, rescue of persons at height. The set objectives of the exercise have been met.

The cooperation exercise "SAFEGUARD" together with the Armed Forces of the Czech Republic took place at the Dukovany NPP from 18 to 21 September 2018. The aim of the exercise was to practically verify the establishment of closures and occupancy of the main access roads (control release sites) by the Armed Forces of the Czech Republic and verify the functioning of the Dukovany NPP under the stricter regime measures. The set objectives of the exercise have been met.

The exercise "ZÓNA 2019" took place at the Temelín NPP from 10 to 12 June 2019, in which a simulated radiation accident at the Temelín NPP was the initial situation. The initiating event for the ZÓNA 2019 exercise was the occurrence of a simulated radiation incident of Unit 1, subsequently due to an unfavourable development categorized as a radiation accident, which was also accompanied by a loss of power supply on Unit 2. The exercise took place in the staff form and data was transferred to the exercise participants by a moderator. The technological scenario of the exercise was developed externally and was unknown in advance to the participants in the exercise. On the second day of the exercise, after the simulated release of radioactive substances into the vicinity of the Temelín NPP, monitoring of the radiation situation in the emergency planning zone was started through a mobile group (2 air and 10 ground groups). The set objectives of the exercise have been met.

Another exercise of this type was supposed to take place at the Dukovany NPP in September 2021; this exercise was first moved to 9 to 12 May 2022 due to the spread of COVID and subsequently cancelled without a replacement due to the situation in Ukraine. According to the prepared scenario, this will be a multi-unit event categorized as a radiation accident. Cooling will be lost on Unit 1 and a power loss event will run in parallel on Unit 2. The events at both units will be associated with a partial fuel melting and the subsequent release of radionuclides into the environment, to such an extent that it will lead to the need for urgent protective measures to protect the population. However, due to compliance with the legislative requirements of the Atomic Act, a limited exercise took place at the Dukovany NPP in September 2021.

In March 2019, the SAFEGUARD Temelín 2019 exercise took place at the Temelín NPP. The aim of the exercise was to test the Armed Forces of the Czech Republic in guarding and defending strategic facilities and cooperation with the Police of the Czech Republic and the physical security of the Temelín NPP. The exercise was mainly focused on activities at control release points and averting an air attack. The set objectives of the exercise have been met.

In 2020, the joint exercise "SAFEGUARD Dukovany 2020" of the Armed Forces of the Czech Republic, the Police of the Czech Republic and the Fire Rescue Service of the Czech Republic with the units providing physical security at the Dukovany NPP, which was to follow up on comprehensive exercises conducted in 2016 and 2018, did not take place on the account of the spread of the COVID-19 disease, subsequent measures taken and the associated cancellation of training of the active reserves of the Armed Forces of the Czech Republic.

In 2021, the joint exercise “SAFEGUARD ETE” of the Armed Forces of the Czech Republic with the units providing physical security at the Temelín NPP did not take place due to the unfavourable development of the spread of the COVID-19 disease.

Due to the epidemiological situation that persisted throughout 2020, it was not possible to fully fulfil the exercise plan of the Crisis Staff of the SÚJB for 2020. The SÚJB and ČEZ cooperation exercises were postponed indefinitely by the licence holder; other exercises on the ČEZ side were either cancelled completely or took place to a limited extent, in compliance with strict hygienic measures. Exercises that could not be conducted in 2020 were included by ČEZ and SÚJB in the exercise plans for 2021, when the conditions for the conduct were slightly more favourable. In 2021, the Crisis Staff of the SÚJB participated in four cooperation exercises with ČEZ. On 11 May and from 20 to 21 September together with the Dukovany NPP, and on 9 September and 16 November with the Temelín NPP.

16.1.5 Regulatory review and inspection activities

The SÚJB inspects the licence holders for radiation extraordinary event management in accordance with the Atomic Act and Act No. 255/2012 Coll., Inspection Code. Inspections in this area are focused on:

- state of the provision of education and training in the field of response to a radiation extraordinary event,
- verification of the procedures and arrangements to ensure detection of a radiation extraordinary event,
- verification of the procedures and arrangements to ensure declaration of a radiation extraordinary event and notification of the authorities concerned,
- verification of the procedures and arrangements to ensure response to a radiation extraordinary event,
- verification of the procedures and arrangements to restrict emergency exposure,
- verification of the procedures and arrangements to verify response preparedness of individuals,
- verification of the procedures and arrangements to document response preparedness,
- performance and documentation of the verification of the functionality of technical means,
- up-to-date nature of on-site emergency plans that have been approved by the SÚJB,
- prepared intervention instructions, their interconnection and relation to the on-site emergency plan,
- fulfilment of the annual plan for verifying radiation extraordinary event response preparedness,
- contractual provision of other persons necessary for the implementation of interventions and activities in the event of a radiation extraordinary event, referred to in the on-site emergency plan.
- In addition to this inspection activity, the SÚJB performs inspections during emergency exercises, in which the scenarios of the occurrence and development of a simulated radiation extraordinary event, activities in the management and implementation of interventions according to the on-site emergency plan and related intervention instructions are monitored.

16.1.6 International arrangements, including those with neighbouring States

Part of applicable legislation in the given area includes the following international treaties signed by the Czech Republic:

- The Convention on Early Notification of a Nuclear Accident (in Vienna on September 26, 1986, declared under No. 116/1996 Coll.);

- The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (in Vienna on September 26, 1986, declared under No. 115/1998 Coll.).

On the basis of the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency", the Emergency Response Network (ERNET, which was later renamed to the Response and Assistance Network (RANET) was established by the IAEA in 2000.

The Czech Republic is a participant in the RANET network since 2009. The system of requesting, delivering and receiving international assistance in the Czech Republic is governed both by rules set out within the RANET network and by relevant legislation of the Czech Republic. Within the RANET network, the Czech Republic registered its national capacities and resources for delivering assistance to other Parties to the above mentioned Convention. Registered were services in the area of source search and recovery, radiation survey, sampling and analysis of environmental samples, radiological assessment and advice as well as dose assessment. All these capacities are currently registered as external support centres.

Provision of humanitarian assistance of the Czech Republic is governed by Act No. 151/2010 Coll., on Foreign Development Cooperation and Humanitarian Aid Delivered Abroad and on Amendment to Related Acts as amended by Act No. 484/2020 Coll. Pursuant to this Act, the Ministry of Foreign Affairs delivers the humanitarian aid to the states outside the EU and the European Economic Area, and decides on its scope and form. The Ministry of Foreign Affairs in cooperation with the Ministry of the Interior decide on the provision of material and rescue support. Pursuant to this Act, the Ministry of the Interior delivers the humanitarian aid to Member States of the EU and other states forming the European Economic Area, and decides on its scope and form. Any assistance within the RANET network would be provided in the Czech Republic as part of the system of providing humanitarian aid.

In addition to the above listed conventions, the Czech Republic has concluded bilateral government agreements on cooperation and assistance in disasters, natural disasters and other extraordinary events with all neighbouring countries and with Hungary, which enables the rescue teams in the case of an extraordinary event to cross the national border in simplified regime. Within the cross-border cooperation, the teams of the relevant territorial unit (Regional Fire Rescue Service) intervene on the territory of the relevant territorial unit of the neighbouring state under the above mentioned agreements. The application for assistance is transferred between the operation centres of the relevant territorial units; on the Czech part, this is the Regional Operation Information Centre of the Fire Rescue Service. All interventions on the territory of another state shall be subsequently reported to the Operation Information Centre of the Ministry of the Interior General Directorate of Fire Rescue Service of the Czech Republic. In addition, the agreements govern, for example, joint trainings, exercises, information exchange, use of radio stations, compensation of damage incurred, use of aircraft etc. The Czech Republic has also concluded bilateral agreements concerning the area of nuclear safety, radiation protection, and radiation extraordinary event management.

A complete list of international and bilateral agreements is provided in Article 7 of the National Report.

16.2 Information of the public and neighbouring States

16.2.1 Preliminary information of the public in the emergency planning zone

Preliminary information of the public in the emergency planning zone is set to form of distributed basic information for the case of a radiation accident at the Dukovany NPP and basic information for the case of a radiation accident at the Temelín NPP. This information is part of the calendars distributed by the operator to all households in the emergency planning zone of Dukovany NPP and Temelín NPP. The calendars are distributed every two years. The content of basic information meets the requirements set out in Section 11 of Decree No. 359/2016 Coll., and Section 155 of the Atomic Act.

In 2018, the system of information of the public via SMS gateway was implemented. The residents in the emergency planning zone have the possibility, after registration on the web portals https://www.aktivnizona.cz/ for Dukovany NPP and https://www.ete.cz/ for Temelín NPP, to receive important information about the operation of nuclear power plants via SMS and e-mail. Basic information for the case of a radiation accident at the NPP can be found on these portals.

16.2.2 Information of the public in the emergency planning zone about occurrence and development of a radiation accident

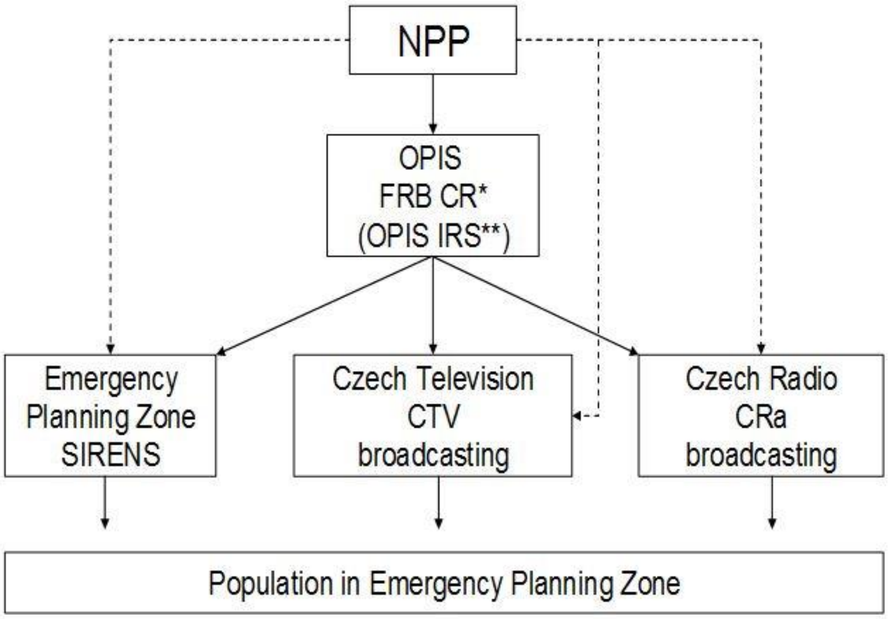
Warning of the public in the emergency planning zone is ensured through terminal elements of a single warning and notification system, which is ensured and operated by the Ministry of the Interior General – Directorate of Fire Rescue Service of the Czech Republic. Warning of the public in the emergency planning zone is performed at the decision of the shift engineer or the Head of ECC immediately upon prompt notification of a radiation accident. The shift engineer (or the Head of ECC) issues a request to start the sirens in the emergency planning zone through the Regional Operation Information Centre of the Fire Rescue Service (for Dukovany NPP, through the Operation Information Centre of the Fire Rescue Service of the Vysočina Region; for Temelín NPP, through the Operation Information Centre of the Fire Rescue Service of the South Bohemian Region).

In case of impossibility to transmit information or impossibility to launch the sirens (within an unified warning and notification system) in the emergency planning zone from the competent Regional Operation Information Centre of the Fire Rescue Service, the shift engineer (or the Head of ECC) shall issue an order to launch the sirens in the emergency planning zone from the backup command workplace at the NPP. In case of failure of the remote launch of the sirens in the territorially competent Regional Operation Information Centre of the Fire Rescue Service and at the NPP, there is an alternative method of warning the public in the emergency planning zone by manually launching each siren of a unified warning and notification system or, if necessary, using all available resources in place, supplemented by patrols of the Police of the Czech Republic and fire protection units with vehicles fitted with warning and radio equipment for the transmission of emergency information. The process of alternative warning of the public in the emergency planning zone is given in the relevant Off-site Emergency Plan.

The population is warned via the sirens by means of a single “general warning” audible warning signal. Emergency information follows immediately after the “general warning” signal fades out. Emergency information (initial warning messages) are radio and television messages pre-prepared by the licence holder with basic information on the occurrence of a radiation accident at the NPP and the behaviour of the population in the emergency planning zone to take urgent protective measures – sheltering, use of iodine prophylaxis and preparation for evacuation. The NPP (at the Dukovany NPP - shift engineer or Administrator, at the Temelín NPP – Electro-control room personnel or Administrator) shall request the territorially competent Regional Operation Information Centre of the Fire Rescue Service to give an instruction to the Czech Television and the Czech Radio to broadcast emergency information.

Fig. 16-6 Schematic representation of the public warning system within the emergency planning zone

(Solid lines indicate the primary warning system and dashed lines indicate the backup system.)



The SÚJB, in accordance with Section 209 of the Atomic Act, on the basis of the results of the radiation situation monitoring carried out, issues proposals for urgent protective actions or follow-up protective actions, or to further specify or withdraw the actions, and confirms or further specifies the proposal for the introduction of urgent protective actions issued by licence holder. Inputs for issuance, clarification or withdrawal of the proposal shall be drawn up by the SÚJB Crisis Staff.

In accordance with Section 9(2) of the Crisis Act, the SÚJB establishes a workplace of emergency response and ensures operation of the SÚJB Crisis Staff. Part of the SÚJB Crisis Staff is also the service of the contact point designed for continuous reception and transmission of information about radiation incidents and accidents.

The activities of the SÚJB Crisis Staff in radiation extraordinary event are aimed at the following:

- evaluation and forecasts of the development of the state of technology in relation to the measures implemented by the operator of a nuclear installation, including the determination of the source term for the release of radioactive substances into the environment, on the basis of the data and information provided from a nuclear installation with the use of technical means, methodical and program tools,
- assessment of the radiation situation at the nuclear installation on the basis of the data and information provided with the use of technical means, methodical and program tools,
- cooperation with the Czech Hydrometeorological Institute to develop a forecast for the dispersion of radioactive substances from the place of a radiation extraordinary event and process information about possible threat in the vicinity of a nuclear installation depending on the meteorological situation and its expected development, including determination and specification of possible levels of radiation situation on the basis of information about the release of radioactive substances from a nuclear installation,

- specification of the source term for the release of radioactive substances and the extent of affected area based on the data and information provided from radiation situation monitoring,
- processing of inputs intended for issuance of the proposal for urgent protective measures or follow-up protective measures or their clarification or withdrawal and also processing of inputs confirming or clarifying the proposal to introduce urgent protective measures issued by the licensee,
- processing of information and reports about the occurrence and the course of a radiation accident which has an impact on the territory of the Czech Republic outside the emergency planning zone and about the steps and measures to be taken during the various stages of development of the radiation accident,
- provision of information about the adoption of measures to protect the general public in the Czech Republic in the event of a radiation accident arisen in the territory of Member States of the Euratom to the European Commission and other Member States of the Euratom which may be affected by these measures and, in accordance with the Czech Republic’s international commitments, provide public access to information thus obtained.

The SÚJB Crisis Staff submits the elaborated background documents, depending on the size of the affected territory, to the Central Crisis Staff and to the Regional Crisis Staff.

Furthermore, the SÚJB Crisis Staff in cooperation with the Operation and Information Centre of the Ministry of Interior – General Directorate of Fire Rescue Service of the Czech Republic ensures:

- notification of the IAEA within the meaning of the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear and Radiation Accident and contact points of the countries based on the closed international bilateral agreements, when continuous operation of the contact point for information transmission is ensured by the Operations and Information Centre of the Ministry of Interior – General Directorate of Fire Rescue Service of the Czech Republic,
- notification of the EU within the meaning of the Council Decision No. 87/600/Euratom,
- providing the public with information.

16.2.3 Arrangements to inform competent authorities in neighbouring States

The Czech Republic is a signatory of the Convention on Early Notification of a Nuclear Accident (the Early Notification Convention) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (the Assistance Convention).

With respect to these Conventions, the SÚJB, in relation to IAEA, acts as the National Competent Authority for an Emergency Abroad/Domestic Emergency. The function of the National Warning Point is ensured by the Operation Information Centre of the Ministry of the Interior of General Directorate of Fire Rescue Service of the Czech Republic. The SÚJB acts as the National Competent Authority for an Emergency Abroad and National Competent Authority for a Domestic Emergency also towards the neighbouring countries.

Towards the EU, the SÚJB acts as the “Competent Authority” and the Ministry of the Interior – General Directorate of Fire Rescue Service of the Czech Republic acts as the “Contact Point”. Information about radiation extraordinary events that may have transboundary impact is provided towards the EU countries, neighbouring States and the IAEA through the USIE systems, ECURIE website or via direct contact with the Contracting Party to the bilateral agreement.

Additional information is provided in the National Report of the Czech Republic on the Emergency Preparedness and Response, SÚJB, 2014[10] [16-1] and in the Special National Report of the Czech Republic under the Convention on Nuclear Safety, SÚJB, February 2012[11] [16-2].

Statement on the implementation of the obligations concerning Article 16 of the Convention

The Czech Republic has adopted and implemented all measures ensuring preparedness to response to a radiation extraordinary event, which are regularly verified, and which cover activities to be performed in the case of a radiation accident. The plans, which include the activities to be carried out in case of a radiation accident, which are prepared and verified before the nuclear installation begins its operation above the minimum level of power established by the regulatory body, are verified regularly. The above mentioned plans are then regularly reviewed throughout the operation of the nuclear installation.

At the same time, such measures are taken which ensure that the public of the Czech Republic as well as the competent bodies of states in the vicinity of nuclear installations, which may be affected by a radiation extraordinary event, received the corresponding information for the preparation of crisis or emergency plans and crisis countermeasures.

[10] https://www.sujb.cz/fileadmin/sujb/docs/zpravy/zprava_EPR_final_en.pdf

[11] https://www.sujb.cz/fileadmin/sujb/docs/zpravy/narodni_zpravy/CZ_NR_2012.pdf

17. SITING

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

(i) for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;

(ii) for evaluating the nuclear safety impact of a proposed nuclear installation on individuals, society and the environment;

(iii) for re-evaluating as necessary all relevant factors referred to in subparagraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;

(iv) for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.

17.1 Evaluation of site related factors

17.1.1 Licensing procedure

Site selection and evaluation of site related characteristics are the crucial steps for the siting of a nuclear installation. Site suitability for the siting of a nuclear is one of the fundamentals of the “defence in depth” principle (IAEA Fundamental Safety Principles SF-1, 2006) and is assessed from the aspect of potential external natural or anthropogenic influences on a nuclear installation and from the aspect of site characteristics, which could affect migration of radioactive substances in the environment.

(Description of the licensing procedure of individual phases of the life cycle of a nuclear installation is included in Chapter 7 hereof).

The legislative framework governing the issue of a siting licence, which covers the nuclear safety and radiation protection aspects, is established by the Atomic Act and its implementing regulations such, as:

- ***Decree No. 378/2016 Coll.,*** on siting of a nuclear installation.
- ***Decree No. 408/2016 Coll***., on management system requirements.
- ***Decree No. 422/2016 Coll***., on radiation protection and security of a radioactive source.
- ***Decree No. 359/2016 Coll***., on details of ensuring radiation extraordinary event management.
- ***Decree No. 329/2017 Coll.***, on the requirements for nuclear installation design.

As mentioned above in Chapters 7 and 8, a licence for siting of a nuclear installation is issued by the SÚJB by the provisions of Section 9 of the Atomic Act.

Application for the nuclear installation siting must be, in accordance with Annex 1 of the Atomic Act, documented by the following documentation:

1. management system program,
2. initial safety analysis report,
3. analysis of physical protection assurance needs and possibilities,
4. intention to ensure the monitoring of discharges from the nuclear installation,
5. monitoring program,
6. intention to ensure radiation extraordinary event management,

7. proposal of the safe decommissioning concept,
8. description of the method of quality assurance for the preparation of construction project implementation, and
9. principles of quality assurance for the subsequent phases of the nuclear installation's life cycle.

17.1.2 Evaluation and siting criteria for nuclear installation

According to the implementing regulations of the Atomic Act, in particular Decree No. 378/2016 Coll., on siting of a nuclear installation and in agreement with the IAEA (in particular SSR-1, 2019; SSG-9, 2010; SSG-35, 2015; NS-G-3.4, 2003, NS-G-3.6, 2004; SSG-18, 2011) and WENRA (Safety Reference Levels for Existing Reactors and Guidance Document Issue T: Natural Hazards Head Document) recommendations, a nuclear installation should be designed while taking into account the historically most significant phenomena registered in the particular site for a nuclear installation and its vicinity, as well as a combination of natural phenomena, phenomena resulting from human activity and accident conditions due to these phenomena. Requirements for the method of evaluation and its scope comply with the VDNS principles.

The Atomic Act further establishes the following requirements:

- Pursuant to Section 5(1) c) – act in a way ensuring that the risk to natural persons and the environment is kept as low as can reasonably be achieved taking into account the current state of technical knowledge and economic and societal aspects.
- Pursuant to Section 5(2) a) – as a matter of priority, ensure nuclear safety, safety of nuclear items and radiation protection, while respecting the present level of science and technology and good practice.
- Pursuant to Section 46(2) e) – ensure resilience and protection of the nuclear installation against the hazards resulting from the site characteristics of the site for a nuclear installation and from external influences.
- Pursuant to Section 47(1) – The site for a nuclear installation shall be evaluated in terms of:
  a) its characteristics that can affect nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security during the life cycle of the nuclear installation, and
  b) the impact of the nuclear installation on individuals, the general public, the society and the environment.

  Furthermore, according to paragraphs 2 or 3:

  Siting of a nuclear installations is prohibited in the area, whose characteristics under paragraph 1(a) reduce the required level of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security during the life cycle of the nuclear installation, so that in terms of the current level of science and technology is not possible to remedy in the form of technical or administrative measures.

  Prior to siting a nuclear installation, a baseline survey of the site for a nuclear installation shall be conducted regarding to radiation situation monitoring by measuring and evaluating the baseline radionuclide content in the environment and food chain. The results of the baseline survey shall be retained for the needs of the complete decommissioning.
- Pursuant to Section 50 – ensure that already reached level of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security of another nuclear installation located in the site for a nuclear installation under constructions is sited does not degrade.

- Pursuant to Section 54 a) – continuously ensure, verify, and document that the nuclear installation is capable of stable and safe operation.

Detailed requirements for the assessment of site characteristics and phenomena for a nuclear installation are laid down in Decree No. 378/2016 Coll., on siting of a nuclear installation, which also provides a list of assessed characteristics and phenomena in Section 3 as follows:

1) Site characteristics, assessed on site for a nuclear installation in terms of their capability to affect the nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security during the life cycle of a nuclear installation, are the occurrences of:

   a) natural characteristics and phenomena, specifically:

      1. seismicity,
      2. crack of the site for a nuclear installation as a result of a fault in the Earth's crust (hereinafter referred to as the "fault"),
      3. floods,
      4. groundwater circulation,
      5. other geodynamic phenomena and geotechnical parameters of the foundation soils,
      6. climatic and meteorological phenomena,
      7. biological phenomena, and
      8. natural fires,

   b) phenomena originated in human activity, specifically:

      1. aircraft crash and crash of any other flying object,
      2. explosions and fires originated in human activity, and their products,
      3. collision with the protection or safety zone,
      4. impact of the nuclear installation already located in the area,
      5. strong vibrations,
      6. electromagnetic interference,
      7. eddy current,
      8. adverse impacts of air, road, rail and waterway transport,
      9. effects of the pipelines and power transmission lines,
      10. pollution of the air, rock environment, surface and groundwater, and
      11. operation of an installation where readily flammable, explosive, toxic, suffocating, corrosive or radioactive material are located or are released therefrom, and

   c) any other phenomenon that may adversely affect the nuclear safety, radiation protection, radiation situation monitoring, radiation extraordinary event management, and security of a nuclear installation.

2) Characteristics of the site for a nuclear installation, assessed in terms of the impact of a nuclear installation on individuals, the public, society and the environment are the occurrences of phenomena capable of affecting the effect of a nuclear installation on the surrounding environment, specifically:

   a) dispersion of radioactive substance via air, ground and surface water, and food chain, and

   b) population distribution and density, and its development.

Decree No. 378/2016 Coll., also regulates the general principles of assessment when pursuant to Section 4:

1) Site evaluation for a nuclear installation shall assess the extent to which the characteristics pursuant to Section 3 are capable of affecting the nuclear safety, radiation protection, radiation situation monitoring, radiation extraordinary event management, and security.
2) The results of the assessment of the site for a nuclear installation shall be compared with the features of the characteristics of the area, the achievement of which causes the siting of a nuclear installation to be prohibited.
3) The evaluation of the site for a nuclear installation shall include the assessment of:
   a) the simultaneous effect and the interaction of characteristics pursuant to Section 3, their intensity and duration;
   b) the future development of characteristics pursuant to Section 3 during the life cycle of a nuclear installation, and
   c) the impact of installed capacity of a nuclear installation on the site for a nuclear installation in case of a nuclear installation with a nuclear reactor.
4) The site evaluation for a nuclear installation shall take place for site area of a nuclear installation and up to such a distance thereof, which allows assessing the impact of characteristics pursuant to Section 3 on nuclear safety, radiation protection, radiation situation monitoring, radiation extraordinary event management, and security, however at least up to the distance determined for that characteristic by this Decree.

It also specifies the characteristics, the achievement of which causes the siting of a nuclear installation to be prohibited.

The Atomic Act and Decree No. 378/2016 Coll., are followed by detailed the SÚJB Safety Guides to assess compliance with the criteria relating to the above phenomena:

- SÚJB Safety Guide BN-JB-4.1, Siting of Nuclear Installation – Assessment of Natural Hazard and Phenomena.
- SÚJB Safety Guide BN-JB-4.2, Siting of Nuclear Installation – Assessment of Human Induced Hazards.

17.1.3 Dukovany NPP

Basic data of the Dukovany NPP site

The Dukovany NPP is situated in the southern part of the Czech Republic, southwest of the city of Brno at the border of the Vysočina Region and the South Moravian Region (see Fig. 6-1, Chapter 6). The distance of the Dukovany NPP from the border of the Republic of Austria is 32 km and 74 km from the border of the Slovak Republic.

The altitude of the Dukovany NPP site ranges from 383 to 389 meters above sea level. Geomorphological character of the landscape north of the site area is ragged with a deep valley of the Jihlava River (the difference in height from the Dukovany NPP site to the water level is approximately 100 m), which changes to a flat terrain south of the Dukovany NPP site.

There are five small towns in the close vicinity of the Dukovany NPP – Třebíč, Náměšť nad Oslavou, Moravské Budějovice, Moravský Krumlov, and Jaroměřice nad Rokytnou. Brno city, with approximately 600,000 inhabitants, including suburban concentrations, is situated about 35 km northeast of the plant. Approximately 98,000 people live within 20 km of the nuclear power plant. The population density in other parts of the territory is very low, with only small settlements.

The site has been selected with regard to minimise possible interactions of the nuclear installation with the adjacent territory. Thus, in the immediate vicinity there are neither large industrial facilities nor frequented transport routes. The density of industrial facilities near Dukovany NPP is significantly lower than in other parts of the Czech Republic territory. The immediate vicinity of the nuclear power plant has an unequivocally agricultural character, and there are only a few small industrial plants.

Protection against external and internal hazards

The Dukovany NPP site is continuously assessed from the perspective of potential external and internal natural phenomena, as well as of the hazards caused by human activities that could, under adverse circumstances, pose a risk to nuclear safety.

For protection against all proposal events and their effects on the nuclear installation, measures were taken in the project conception to ensure the protection of structures, systems, and equipment important from the perspective of nuclear safety and protection of the operation staff. As part of updating of the Final (Operational) Safety Analysis Report, the assessment of the external and internal phenomena is regularly updated, and if new knowledge is identified, with an impact on nuclear safety, an adequate project measure is proposed.

Seismicity

The area within 25 km from the Dukovany NPP site is continuously monitored by the Kozének local seismic station and by the local seismic monitoring network that was built between 2013 and 2015, and consists of five stations: NADU, MYDU, RUDU, SEDU and KRDU. The KRDU station continues the registration of KRUC – Dukovany NPP where the measurement took place from 1995, which ensures the continuity of measurement in this territory. Records of the monitoring network are continuously evaluated by the Institute of Earth Physics of the Faculty of Science of the Masaryk University in Brno - and are published on the publicly accessible information display[12].

The determination of the seismic risk at the Dukovany NPP was elaborated in 2015 in compliance with the IAEA SSR-1 and SSG-9 standards, under the use of the Probabilistic Seismic Hazard Assessment (PSHA). The SL-2 value was expressed in compliance with the provision of the IAEA NS-G-1.6 instructions as the value of the acceleration of ground vibrations that will be exceeded within 10,000 years with a 50 % probability. The environment of metamorphosed rocks of a monotonous group of the Moldanubian Zone of the Bohemian Massive is characterized by low seismicity; for the site of Dukovany NPP, the SL-2 value equals to 0.047 g (47 cm/s^{-2}) [17-1], [17-2]. According to the results of hazard disaggregation, the potential source areas of the earthquake zone with high seismicity in the Eastern Alps and in the Western Carpathians are the most important for this Dukovany site. In 2021, a new PSHA was drawn up for the Dukovany NPP site as the basic data for the IAEA SEED Mission, scheduled for May 2022.

Tectonic activity, territory deformation, geodynamic phenomena

From the geological perspective, the Dukovany NPP is situated in the southeastern part of the Bohemian Massif.

The Bohemian Massif is part of the European Variscan or Hercynian orogeny and includes the territory of Bohemia and West Morava up to the Znojmo - Přerov - Karviná line (beyond this boundary, the Bohemian Massif falls under the Western Carpathian unit) and further the peripheral part situated in Poland, Germany, and Austria. This extensive regional geological unit, which includes the power plant site and its surroundings, is the Moravian Mondanubian Zone, consisting of metamorphosed rocks (paragneisses, orthogneisses, migmatites, granulites, amphibolites and serpentinites). The younger Neogene sediments are deposited on these rocks (typically gravels and sands moldavites) and superficial quaternary sediments (fluvial and colluvial sediments, loesses and loess clays) [17-3].

[12] http://sid.ipe.muni.cz/

The assessment of the tectonic conditions and the potential occurrence of a movement-capable fault in the Dukovany NPP site and in the area at the minimum distance of 25 km from the nuclear installation takes place continuously. The latest additional geological surveys prove that no tectonic structure meeting the definition of a fault potentially capable of movement was identified on the site area and in its close environment [17-4], [17-6], [17-7].

No occurrence of landslides and other slope deformations is registered on the power plant site area and in its close environment; no karst or rocks susceptible to karst development are present in the territory. No occurrence of post-volcanic phenomena or mineral water springs linkable to past volcanism was found either.

Concerning the bedrock consisting of crystalline rocks covered by rocky eluviums, no conditions for liquefaction of soil are created in the Dukovany NPP site area and its surroundings. No historical mining or other activities leading to subsidence or deformation of the territory surface took place here.

Floods, potential for flooding

Surface water

The Dukovany NPP site is situated in the hydrological divide of catchment areas of the Jihlava and Rokytná Rivers. The Jihlava River with the Dalešice – Mohelno dam system and the repumping hydroelectric power plant is the biggest watercourse in this area, running north from the nuclear power plant in a deeply cut valley, from which the technological water is taken and at the same time the wastewater is discharged. Jihlava River flow at the in-flow to waterworks Dalešice varies around the average annual value of 5.4 m^3s^{-1}.

The analysis of flooding and prognostic scenarios of floods show that the Dukovany NPP site area, thanks to its position on the plateau at an altitude of 383,5 – 389,3 m a. s. l., situated at a higher level than the maximal possible height of the levels of the Dalešice–Mohelno dam system in case of a flood with ten-millennial water flow and in case of a hypothetic damage to the Dalešice dam, is not endangered by flooding from the Jihlava River or by flooding from the surrounding small watercourses in case of flood at centennial water flow. The assessment of other potential flooding sources, e.g. the local intensive precipitations, potential failure of the dams caused by seismicity, maximal flooding from the heave and swinging of the water levels, the effect of ice or occurrence of a tsunami shows a very low or no risk of danger [17-8], [17-9].

Groundwater

The groundwater at the Dukovany NPP site and in its surroundings is bound to porous rock medium of Neogene sediments and to fissure fractured rock medium of crystalline rocks of the Moldanubian Zone mainly to the zone of near-surface disconnection of fractures.

The permeability of both rock media is relatively low; based on hydraulic tests, the coefficient of hydraulic conductivity of Neogene sediments was determined in orders of 10^{-6} to 10^{-7} $m.s^{-1}$. A similarly low coefficient of hydraulic conductivity was found in the fractured medium of metamorphic rocks where the values reach a range of $3.1 \cdot 10^{-4}$ to $3.0 \cdot 10^{-5}$ $m \cdot s^{-1}$, with prevailing values in the interval of 1.4–$3.0 \cdot 10^{-5}$ $m \cdot s^{-1}$ [17-10].

There are no significant groundwater aquifers in the area within 25 km from the nuclear installation, only local sources (wells, boreholes). The Dukovany NPP site area and the close vicinity do not reach any protected area of natural water accumulation either.

The Dukovany NPP construction constituted a marked impact on the groundwater regime on the land where the premises are situated. At present, a layer of anthropogenic backfills with a thickness of up to 6 m is situated here. The groundwater from the site area is continuously pumped by a system of boreholes; the drainage is implemented by a segregated sewerage system. The outflow of the precipitation, sewage and industrial water from the power plant site area is implemented by gravitation and it can be controlled in an organized manner primarily in case of the industrial sewerage system. The pumped amount of groundwater and its potential impact on the corrosiveness of the structures and buildings are continuously monitored.

The nuclear power plant operates a groundwater monitoring network. The regular monitoring is evaluated in detail in annual reports. Between 2014 and 2017, the existing monitoring network was expanded by 30 hydrogeological boreholes that monitor the land proposed for the siting of new units and its surroundings. The results of monitoring of groundwater from these boreholes are evaluated in detail in the periodic reports [17-11]. In 2015, a regional conceptual model of the flow of surface water and groundwater and the transport of contaminants was developed for the defined area of the Dukovany NPP and its surroundings [17-12]. The conceptual model was updated in 2016 for the closest vicinity of the site area and the land for the siting of new units in the form of a detailed mathematical model of groundwater flow and transport of contaminants.

Climatic conditions, occurrence of extreme meteorological phenomena

Specific meteorological measurements and observations for the Dukovany NPP region have been carried out continuously by the meteorological observatory of the Czech Meteorological Institute at Dukovany since June 1982. For its regular synoptic and climatological measurements, the observatory uses standard meteorological instruments. From the macroclimatological perspective, the location is situated in the area of the temperate climatic zone of Northern Hemisphere. According to the classification of the climatic areas of the Czech Republic [17-13] the Dukovany NPP region can be classified as a site at the boundary of warm climatic areas MT7, MT11 and MT6, based on the data measurement for the period from 1961 to 2010.

The average annual temperature in the period of 1961–2012, reaches 8.3°C, with standard deviation of 0.9°C. July with average temperature of 18.7°C is usually the warmest month, while January with an average temperature of -2.2°C is the coldest month. The total annual precipitations for the period of 1953–2012 amount to 490 mm on average, with a standard deviation of 94 mm and it oscillates between the values of 358 mm and 821 mm.

Extreme and exceptionally occurring meteorological phenomena are analysed based on series measured in the meteorological observatory of the Czech hydrometeorological institute of Dukovany and in other stations with comparable meteorological conditions in the environs of the Dukovany NPP, for example according to the [17-14] methodologies. Estimates of maximal and minimal air temperatures for the site, as well as their supposed non-exceeding until 2030, estimates of 1 sec and 10 sec and 10 min wind load (m/s) per 100 and 10,000 years, estimates of torrential precipitations for the repetition period of 100 years and 10,000 years, estimates of the centennial, millennial and ten-millennial water value of snow (mm) have been determined [17-15]. Estimates of impacts of climatic change are considered based on the research project of the Czech Hydrometeorological Institute [17-16]. The occurrence of tornadoes in the Dukovany site area is currently being re-evaluated, considering the occurrence of tornadoes of F4 intensity on 24 June 2021 in the municipalities of Hrušky, Moravská Nová Ves, and Hodonín. The place of occurrence of the tornado is about 70 km from the Dukovany NPP.

Accidental aircraft crash, and flying and falling objects

The airspace above the nuclear power plant with a radius of 2 km and a height of 1500 m has been proclaimed prohibited, and marked LK P9, for all flights in the document “Flight Information Manual”, which is binding on all users of the Czech Republic airspace.

The Dukovany NPP is located in close vicinity of military airfield Náměšť (approximately 10 km).

Probabilistic as well as deterministic analyses of the possibility and consequences of an accidental aircraft crash of various categories were carried out. The assessment of the protection against the effects caused by an accidental aircraft crash was performed following the IAEA recommendations. The results of the calculations have shown that an accidental aircraft crash would not cause inadmissible destruction of the primary system because its civil constructions important to nuclear safety are sufficiently resistant to the possible impacts of such an accidental aircraft crash. The analyses have also shown that the spatially isolated backed-up core cooling systems, together with civil protective structures, ensure that even an accidental aircraft crash will not affect the function of the reactor emergency shutdown and cooling.

Protection against explosion pressure waves

At a distance of about 500 meters of the Dukovany NPP site area, there is a frequented second-class road no. 152 – Brno, Ivančice, Dukovany, Jaroměřice nad Rokytnou, and Moravské Budějovice. Other roads in the vicinity are less frequented. The analyses have shown that even in the case of a very improbable explosion of a transport vehicle carrying dangerous freight, plant safety will not be affected.

The plant has a single-line railway from the eastern direction of Moravský Krumlov and Brno. The probability of a train accident of trains carrying dangerous freight, both in present and in long-term prospect is practically zero.

In the plant vicinity, there are no external sources of potential hazards. The analyses have shown that a potential explosion of hydrogen during its transport and storage, which represents the predominant source of possible explosions within power plant premises, will not endanger systems important to safety so that the safety function of the equipment will not fully fail. Attention is paid to the handling of hydrogen storage bins located outside the reactor units to minimize the possibilities of hydrogen escape.

Protection against influence of third parties

The nuclear power plant design also considers the protection against the influence of third parties. Safety systems are redundant and spatially distant the same is valid for their power supply. This engineered safety is supplemented with a technical, organizational and regime system of measures, which shall prevent the inadmissible influence of third parties.

17.1.4 Temelín NPP

Basic data of the Temelín NPP site

The Temelín NPP is situated in the southern part of the Czech Republic in the territory of the South Bohemian Region, north of the city of České Budějovice. The distance of the Temelín NPP from the Republic of Austria is 49 km and the German border is 57 km.

The altitude of the Temelín NPP site area ranges from about 492 to 508 meters above sea level. The geomorphological character of the landscape north-west of the site area is ragged and rises to a height of 627 metres above sea level (Vysoký Kamýk); about 4 km west of the Temelín NPP site area, there is a deep valley of the Vltava River (difference in height between the Temelín NPP site area and the water level is approximately 150 m).

The nearest village about 1.2 km west of the border of the Temelín NPP site is the Temelín village with 871 inhabitants. The town of Týn nad Vltavou is located at a distance of about 4.4 km and has 8,089 inhabitants; the town of Vodňany with 6,870 inhabitants is 14 km away. The largest city near the Temelín NPP site – České Budějovice, is at a distance of 22 km and has about 93,250 inhabitants. Approximately 303,000 persons live within a radius of 30 km around the nuclear power plant, according to the general census of the population in 2011. The population density in other parts of the territory is very low, with only small settlements.

The site was selected to minimize interactions of the nuclear installation with the surroundings - there are no big industrial facilities in the immediate vicinity and the density of industrial premises is considerably lower in South Bohemia than on the remaining territory of the Czech Republic. The immediate vicinity of the nuclear power plant has an unequivocally agricultural character, and there are only a few small industrial plants. No industrial development in the 10 km area in the perspective is planned.

Protection against external and internal hazards

The Temelín NPP site is continuously assessed from the perspective of potential external and internal natural phenomena, as well as of the hazards caused by human activities that could, under adverse circumstances, constitute a danger to nuclear safety.

For protection against all proposal events and their effects on the nuclear installation, measures were taken in the project conception to ensure the protection of structures, systems, and equipment important from the perspective of nuclear safety and protection of the operation staff. The assessment of the external and internal phenomena is regularly updated, and if new knowledge is identified, with an impact on nuclear safety, an adequate project measure is proposed.

Seismicity

The area within 25 km from the Temelín NPP is continuously monitored by the local seismic monitoring network in which measurement has been taking place since 1991. The network was modernized between 2004 and 2005. Another technological modernization of all components of the stations was completed in 2016. Records of the monitoring network are continuously evaluated by the Institute of Earth Physics of the Faculty of Science of the Masaryk University in Brno - and are published on the publicly accessible information display[13].

The updated assessment of the seismic hazard to the Temelín NPP was elaborated between 2013 and 2014 in compliance with the IAEA NS-R-3 and SSG-9 standards, under the use of the Probabilistic Seismic Hazard Assessment (PSHA). The SL-2 value was expressed in compliance with the provision of the NS-G-1.6 instructions as the value of the acceleration of ground motions that will be exceeded within 10,000 years with a 50 % probability. For the Temelín NPP site, the value equals to 0.03 g (30 cm/s^{-2}). According to the results of the deaggregation of hazard, the areas of Mürz Valley and Vienna Basin are the potentially most important source areas of earthquake for the site. From the long-term perspective of 10,000–100,000 years, the close areas with diffuse seismicity and the fracture of Hluboká are important as well. In 2021, the new PSHA was elaborated for the Temelín NPP site.

In 2003 and 2013, the IAEA mission "Follow-up review mission on seismic hazard issues at Temelín NPP, Czech Republic" took place for the Temelín NPP. The IAEA ISSC Site and External Events Design IAEA Mission on Seismic Hazard at Temelín NPP and Dukovany NPP sites is planned for 2022.

Tectonic activity, territory deformation, geodynamic phenomena

From the geological perspective, the Temelín NPP is situated in the southeastern part of the Bohemian Massif.

The Bohemian Massif is part of the European Variscan or Hercynian orogeny and includes the territory of Bohemia and West Morava up to the Znojmo - Přerov - Karviná line (beyond this boundary, the Bohemian Massif falls under the Western Carpathian unit) and further the peripheral part situated in Poland, Germany, and Austria. This is the extensive regional geological unit. The closest vicinity of the Temelín NPP site is formed both by monotonous and varied groups of the Moldanubian Zone composed mainly of migmatites, gneisses (with the occurrence of quartz and hornfels lences and

[13] http://sid.ipe.muni.cz/

granite and pegmatite dykes). The residues of younger Neogene sediments (sands, gravels, and clays) and Quaternary sediments (fluvial, diluvial sediments, loess and loess clays) can be sporadically found on these rocks. The region at an approximate distance of 25 km from the nuclear installation is reached by granites and syenites from the north and by sediments of the Budějovice and Třeboň basins from the south and east.

The physical-mechanical properties of soils and other parameters of crystalline rocks in the Temelín NPP site area and its surroundings exclude the occurrence of landslides, other slope deformations or plastic extrusion of subsoil. The region around the nuclear installation does not consist of karst or rocks susceptible to karst development. No occurrence of post-volcanic phenomena or mineral water springs linkable to past volcanism was found. No soils were found on the Temelín NPP site area, whose properties could indicate susceptibility to liquefaction or swelling; mining of minerals has not taken place here, and the site area is not undermined.

Additional geological studies carried out in recent years show that no tectonic structure meeting the definition of a capable fault has been identified on the Temelín NPP site or in its close environs [17-17, 17-18].

Floods, potential for flooding

Surface water

The Temelín NPP site is situated on the watershed divide of catchment areas, the Vltava River and the Bílý potok. The Bílý potok belongs to the catchment area of the Blanice River, emptying into it between the towns of Vodňany and Protivín. Two water works were built on the Vltava River for the purpose of the Temelín NPP. They are: the Hněvkovice water reservoir, situated at about 4 km to the west, and the Kořensko water reservoir, situated at 6 km to the north from the Temelín NPP site. The Hněvkovice dam serves as source of raw water. The Kořensko dam serves for homogenization of the sewage water discharged. Vltava River flow at the in-flow to waterworks Hněvkovice varies around the average annual value of 27.6 m^3s^{-1}.

The analysis of flooding and prognostic scenarios of floods shows that the Temelín NPP site, thanks to its position at an altitude approximately 129 m higher than the maximal possible level heights in the Hněvkovice dam and the Kořensko dam in case of flow of ten-millennium water, caused by a hypothetic damage to the Lipno dam and subsequent damage to the Hněvkovice dam, is not endangered by flooding from the Vltava River. The Temelín NPP site is not endangered by flooding from surrounding small watercourses in case of flood at centennial water flow.

Groundwater

The groundwater on the Temelín NPP site and in its vicinity is bound to fissure fractured rock medium of crystalline rocks of the Moldanubian Zone or to the zone of near-surface disconnection of fractures; the groundwater in wider environs occurs in sediments of small residues of Neogene sediments and to the sediments of South Bohemian basins (Upper Cretaceous and Miocene sediments with intergranular porosity).

Shallow circulation of groundwater is manifested most distinctly in the most permeable zone down to depths of about 30 m, but it can be found down to the depths of drainage base levels, i.e., 100–150 m. It is characterized by intensive groundwater circulation, completed by areal infiltration from precipitations, and in a more permeable environment, it runs towards local drainage bases (sources and valleys of small watercourses); in its deeper part, it runs to the zone of regional drainage (Vltava River, or Blanice in the west). In greater depths, a lower zone of slowed groundwater flow exists and is characterized by slow groundwater flow with a long period of hold-up (up to more than 10 thousand years), on not very frequent permeable tectonic lines whose frequency decreases further with increasing depth. None of the surveys carried out so far found any facts indicating potential closer communication between shallow and deep flows or flowing of groundwater to greater distances without being influenced by local drainage bases of local watercourses (e.g., the actual conceptual model of groundwater flow [17-19]).

The closest vicinity of the Temelín NPP site area does not collide with any protected area of natural water accumulation. The Natural water accumulation protected area – the Třeboň basin is situated the closest to the Temelín NPP and separated from the Temelín NPP site by the erosion base of the Vltava River; given the terrain morphology, the character of the rock medium and the conditions of groundwater flow, its influencing is excluded.

The Temelín NPP site area is permanently drained by a system of pumping wells; on the site area and its surroundings work the groundwater monitoring network in which regular monitoring takes place, being evaluated in more detail in annual reports of the environmental impact of the nuclear installation.

Climatic conditions, occurrence of extreme meteorological phenomena

The characteristic of the meteorological conditions crucial for the project and operation of the Temelín NPP is based on the meteorological data of the closest stations within a radius of 30 to 100 km around the power plant for the period of 1901–2012, as well as on the observation of the actual station in Temelín for the period of 1989–2012, depending on the type of meteorological information and availability and quality of observation data.

From the macroclimatological perspective, the Temelín NPP site is situated in the area of the temperate climatic zone of the Northern Hemisphere. According to the classification of the climatic areas of the Czech Republic [17-13], the location can be classified as a site at the boundary of warm climatic areas MT7, MT10 and MT11, based on the data measurement for the period from 1961 to 2010.

The average annual temperature for the period from 1876 to 2012 is 8.4°C with a standard deviation of 0.8°C; the average temperature of the coldest month (January) amounts to -1.2°C, the average temperature of the warmest month, June, amounts to 18.2°C. The total annual precipitations for the period of 1876–2012 amount to 603 mm on average, a with standard deviation of 143 mm, and oscillate between 370 and 1060 mm. The suitability of the site is not limited by an increased incidence of extraordinarily adverse dispersion conditions in the atmosphere.

Extreme and exceptionally occurring meteorological phenomena are analysed based on series measured in the meteorological observatory of the Czech Hydrometeorological Institute of Temelín, where measurement has been carried out since 1989, and in other stations with comparable meteorological conditions in the environs of the Temelín NPP site.

Estimates of maximal and minimal air temperatures for the site, as well as their supposed non-exceeding until 2080, in 100 and 10,000 years, estimates of torrential precipitations for the repetition period of 100 years and 10,000 years, estimates of the centennial, millennial and ten-millennial water value of snow (mm) and estimates of 1 sec and 10 sec and 10 min wind load (m/s) have been determined [17-20, 17-21]. Estimates of impacts of climatic change are considered based on the research project of the Czech Hydrometeorological Institute [17-16].

Accidental aircraft crash, and flying and falling objects

The airspace above the Temelín NPP with a radius of 2 km and a height of 1500 m has been proclaimed prohibited, and marked LK P2, for all flights in the document "Flight Information Manual" which is binding on all users of the Czech Republic airspace.

Probabilistic, as well as deterministic analyses of the possibility and consequences of an accidental aircraft crash of various categories were carried out. Analyses have shown that the power plant is protected against the effects caused by an accidental aircraft crash. An assessment of the protection against the effects caused by an accidental aircraft crash was performed in accordance with the IAEA recommendations. The results of the calculations have shown that an accidental aircraft crash would not cause inadmissible destruction of the primary system because its civil constructions important to nuclear safety are sufficiently resistant to the possible impacts of such an accidental aircraft crash. The analyses have also shown that the spatially isolated backed-up core cooling systems, together with civil protective structures, ensure that even an accidental aircraft crash will not affect the function of the reactor emergency shutdown and cooling.

Protection against explosion pressure waves

In the vicinity of the Temelín NPP site three branches of the transit gas line of 1400 mm, 1000 mm and 800 mm diameter are situated. Their minimum distance from the plant reactor buildings is about 900 m. Transit gas line transports natural gas. Analyses have shown that even the maximum postulated accident on the gas line (simultaneous break of all three branches) would not impair the functions of the buildings and technological equipment. A series of measures were adopted to reduce the probability of a pipe accident occurrence and for the mitigation of possible consequences. The principal ones are the additional implementation of spherical valves, shortening of isolable gas pipe sections and a system for natural gas leakage monitoring.

At the southeast boundary of the Temelín NPP site area, there is a frequented secondary road no. 105 České Budějovice – Týn nad Vltavou. Other roads in close vicinity are less frequented. At a distance of more than 10 km, there are two sections of international roads used also for transportation of hazardous freights (ARD). However, the analyses have shown that even in case of a very improbable explosion of a transport vehicle carrying dangerous freight, the plant safety will not be affected.

The nearest railway situated about 1.4 km from the power plant is the local railway line Číčenice – Týn nad Vltavou with passenger and goods trains. Passenger trains are very infrequent. On this line, the probability of an accident of trains carrying dangerous goods both at present and in the long-term prospect is practically zero.

Protection against influence of third parties

The nuclear power plant design also consider the protection against the influence of third parties. Safety systems are redundant and spatially distant, the same is valid for their power supply. This engineered safety is supplemented with a technical, organizational and regime system of measures, which shall prevent the inadmissible influence of third parties.

17.1.5 Information for preparation of new nuclear units in the Czech Republic

The Government of the Czech Republic approved the “National Action Plan for the Development of the Nuclear Energy Sector in the Czech Republic”[14] on 3 June 2015, which follows the updated State Energy Concept[15] and is within the limits of its strategic task (with final opinion from the environmental impact assessment process), transforms any sub-targets of this document into particular implementation steps.

The Resolution of the Czech government No. 48 of January 25, 2016, approved the statute of the Permanent committee for nuclear power engineering, which is a permanent interdepartmental coordination and consultative body of the government for issues of nuclear power engineering and implementation and update of the National action plan of development of nuclear power engineering in the Czech Republic.

[14] https://www.mpo.cz/assets/en/energy/electricity/nuclear-energy/2017/10/National-Action-Plan-for-the-Development-of-the-Nuclear-_2015_.pdf

[15] https://www.mpo.cz/assets/dokumenty/52826/60663/634993/priloha001.pdf

On February 18, 2019, the Czech Government approved Resolution No. 132, changing the title of the Standing Committee for Nuclear Energy to the Standing Committee for the Construction of New Nuclear Units in the Czech Republic (hereinafter referred to as the “Standing Committee”) and approved its new status.

Specifically, as regards the construction of new nuclear units in the territory of the Czech Republic in accordance with the strategic task defined in the State Energy Concept, it is desirable, in view of ensuring energy security of the Czech Republic and the overall social benefit, from the perspective of the state, to immediately begin preparations for the siting and construction of one nuclear unit at the Temelín NPP site and one unit at the Dukovany NPP site.

An interstate environmental impact assessment (EIA) procedure for new units took place in the Temelín NPP site area between 2008 and 2013, which was completed by the issue of EIA consent by the Ministry of the Environment; according to the amendment of Act No. 100/2001 Coll., the validity of this consent was extended to 7 years, i.e., until January 18, 2020.

In the course of 2019, the background studies and the final report for the Ministry of the Environment were updated, which were part of the application for the extension of the EIA consent. The application for the extension of the EIA consent was submitted to the Ministry of the Environment at the end of 2019, and the validity of the EIA consent was extended by the Ministry of the Environment to 5 years, i.e., until January 18, 2025.

The licensing procedure under the Atomic Act for the siting phase of a new nuclear unit in the Temelín NPP site was opened by ČEZ, a. s., in November 2012 and completed in October 2014 by the issue of the SÚJB licence to place nuclear facilities of Units 3 and 4 in the Temelín NPP site (with the validity until December 31, 2020). In accordance with the transitional provisions of the new Atomic Act, the licence holder shall provide the documentation for the licensed activity in accordance with this Act within two years after its entry into force. Based on this requirement, the revised documentation was submitted to the SÚJB at the end of November 2018, in the structure and with the content according to the requirements set out in Annex 1 to the Atomic Act and in accordance with the requirements of its implementing regulations.

On the basis of the request of ČEZ, a. s., of August 21, 2020, and the amended documentation for the siting of Temelín NPP Units 3 and 4, a new the decision on permit for the siting of nuclear facilities of Units 3 and 4 in the Temelín site was issued by the SÚJB on November 4, 2020, with the validity for an indefinite period of time according to the Atomic Act.

In the Dukovany NPP area, the EIA procedure has been running since 2016. Following the publication of the EIA documentation of the new nuclear unit project, to which the statements of competent authorities, the authorities of regional self-government units concerned and statements of the general public, including the foreign public, were applied, the discussion of the EIA documentation was subsequently held, both in the context of interstate consultations offered to neighbouring States by the Ministry of the Environment in accordance with Section 13(3) of Act No. 100/2001 Coll. (EIA Act), and Article 5 of the Espoo Convention and in the context of other meetings organized by the Ministry of the Environment with the general public.

The interstate consultations with German representatives under the leadership of the Ministry of the Environment were held in Prague on April 6, 2018, followed by interstate consultations with the Republic of Austria, held from April 10 to 11, 2018. In the context of public participation in the EIA procedure, the public hearing took place in Budapest, Hungary on May 3, 2018, followed by public discussions in Austria (Vienna, June 6, 2018) and Germany (Munich, June 13, 2018). Subsequently, the public hearing concerning the intention was held at the Ice Hockey Arena in Třebíč on June 19, 2018, within the meaning of the EIA Act, which was attended by about 250 persons – representatives of the authorities of regional self-government units concerned, the competent administrative authorities and other expert representatives from Austria and the Czech public.

Based on the EIA documentation and the applied statements and considering the findings of the public hearing and interstate consultations on EIA documentation, a report was drawn up. At the end of the whole EIA procedure, the Ministry of the Environment issued based on the EIA documentation, statements submitted to it, the public hearing, and the report a binding statement on the environmental impact assessment (EIA statement) on August 30, 2019. The validity of the EIA statement is 7 years from the date of issue with the possibility of extension by 5 years, even repeatedly. The EIA statement serves as a basis for issuing decisions in subsequent procedures (e.g., planning permit, building permit procedures).

In the years 2015–2019, development of the necessary supporting documentation to the application for a licence for the siting of a new nuclear unit under the Atomic Act took place in the Dukovany NPP site area. Works were mainly focused on the evaluation of geological, geotechnical, seismic-tectonic, hydrological and hydrogeological characteristics of the siting area. On March 25, 2020, Elektrárna Dukovany II, a. s., applied for a licence for the siting of two nuclear units, each with a maximum capacity of 1,200 MWe. This step initiated an administrative procedure, which was terminated in accordance with the Atomic Act on March 8, 2021, by issuing a SÚJB licence for the siting of two nuclear units in the Dukovany site area (the licence is issued for an indefinite period).

On June 1, 2021, planning permit procedure was initiated pursuant to the Building Act concerning the siting of the new nuclear source in the Dukovany NPP site area. The application was submitted to the competent building authority. The project is in accordance with the Territorial Development Policy of the Czech Republic and the Principles of Territorial Development of the Vysočina Region. The planning permit procedure follows the EIA procedure and, as in the case of the licence for siting under the Atomic Act, the planning permit procedure concerns up to two units with a maximum output of up to 2,400 MWe.

17.1.6 Regulatory review and inspection activities

The SÚJB specialists and external experts perform continuously assessments of all types of safety documentation providing the evaluation of the characteristics and phenomena occurring at the sites of nuclear installations throughout the lifetime of the nuclear installations. The operators of nuclear installations continuously assess the potential for natural and human-induced hazards under the periodic safety review and annual updates of safety analysis reports in terms of all the requirements for the evaluation of the characteristics and phenomena at the site for a nuclear installation, requirements for design basis, requirements for the assessment of nuclear safety, radiation protection, radiation extraordinary event management, requirements for resistance and protection against hazards resulting from the characteristics of the area, and requirements for the management system – according to the Atomic Act and its implementing regulations: Decree No. 378/2016 Coll., Decree No. 329/2017 Coll., Decree No. 162/2017 Coll., and Decree No. 408/2016 Coll., and relevant international documents of the IAEA, WENRA and the European Commission.

In addition to the criteria and requirements laid down by legislation, the SÚJB has also the possibility and the SÚJB made use of it in both cases, to impose requirements on the operator (ČEZ, a. s.) for the future evaluations in the licence for further operation, when further operation shall be conditional on their performance. Their fulfilment is continuously monitored by the regulatory body.

The ČEZ, a. s., and its experts conduct other geological, hydrogeological, engineering-geological and other surveys in the lands planned for the siting of new units of Dukovany NPP and Temelín NPP sites. This activity and the resulting technical documents are monitored and consulted by the SÚJB in terms of compliance with the requirements set out in the Atomic Act and its implementing regulations, particularly Decree No. 378/2016 Coll., on siting of a nuclear installation.

The updated version of the Initial Safety Analysis Report for New Nuclear Units 3 and 4 of the Temelín NPP was submitted on November 30, 2018, which is reviewed in detail for compliance with the new legislation.

Regulatory staff in the field of siting nuclear installations and site characteristics evaluation created the relevant parts of the Atomic Act and its implementing regulations. At the same time, they create methodologies and safety guides on how to meet the regulatory requirements for nuclear safety by the applicant and the licence holder and are responsible for the preparation of internal methodological instructions for carrying out regulatory inspection and review activities in the field of its expertise.

17.2 Environmental impact assessment of nuclear installations

This chapter describes the process of environmental impact assessment of nuclear installations.

The criteria for assessing the likely impact of the nuclear installation on the safety of the surrounding population and the environment and implementation of these criteria in the licensing procedure are stated in Chapter 15.

The environmental impact of the Dukovany NPP and Temelín NPP has been minimized and is constantly observed, monitored, and controlled. This is demonstrated by the introduction of the Environmental Management System (EMS), which was certified at Dukovany NPP in 2001 and at Temelín NPP in 2004. The certification was executed by the company Det Norske Veritas, the certificate was issued based on Dutch accreditation Rv. The recertifications executed up to now (the latest in 2010) found conformance with standard EN ISO 14 001 and thus they confirmed a justified holding of the certificate.

At Temelín NPP the environment components are monitored in compliance with the requirements of the legislation, and, besides, according to a special extended Program of Environmental Impact Monitoring and Assessment already for many years. This allowed obtaining basic information prior to putting the power plant into permanent operation, which will be used for reference levels.

The above-mentioned “Program of Environmental Impact Monitoring and Assessment", which has been performed since 2000, covers all environmental areas, i.e., atmosphere and climate, surface waters, soil, geo-factors and underground waters, agro-systems, ionising radiation, and the public. The program was elaborated by the company Investprojekt Brno and the individual areas were elaborated by the representatives of universities and research institutes. The employees of the Academy of Sciences of the Czech Republic represented opponents of the proposal. The program was approved in 1999 and the Temelín NPP assures its fulfilment starting from the subsequent year. The environmental status before the Temelín NPP Unit 1 commissioning, i.e., by 2000, was evaluated, the data were statistically processed and it forms the “zero”, in other words pre-operational, environmental status. Data measured after the putting of Temelín NPP Unit 1 and 2 into operation are and will be related to this status.

The results of the monitoring and assessment are summarized each year in an annual report, elaborated by the individual solving parties of the “Program”, and issued annually in a summary report. Its guarantor is the Water Research Institute TGM, Prague.

During construction, following the newly adopted legislation, the Environmental Impact Assessment (EIA) was performed for all substantial design changes. The Ministry of the Environment issued a positive opinion of this assessment.

In addition, based on the “Melk Protocol” concluded in December 2000 between the prime ministers of the Czech Republic and Austria with the presence of the EU commissioner for the enlargement. Another assessment of the nuclear plant impact on the environment was performed in the time period January – June 2001. This assessment was performed following the applicable EU regulations dealing with the assessment of the impact of projects on the environment, but beyond the scope of then effective Act No. 244/1992 Coll., on Environmental Impact Assessment.

The possible impact was monitored in the following areas: climate and air, hydrology, geology and seismicity, impact on the populations' health, influence on nature and landscape, waste (including radioactive waste) and possibilities of emergencies.

The Commission appointed by the government of the Czech Republic and having performed the assessment concluded that "the environmental impact of the Temelín NPP is small, insignificant and acceptable". In the conclusion, the Commission recommended 21 measures aimed in particular at intensifying the monitoring of all influences during future plant operation. The measures are continuously fulfilled and regularly assessed.

Both the EIA process and the assessment within the "Melk Protocol" procedure were accompanied by a proper public hearing, where all questions and comments raised by the public of the Czech Republic, the Republic of Austria and Germany were answered.

17.3 Continuous evaluation of site related factors

This chapter describes the activities of re-evaluation of site related factors as stated in Article 17 paragraph 1 of the Convention and to ensure continuous acceptability of the safety of a nuclear installation performed under the relevant standards and procedures, the conclusions of recent re-evaluation activities, and regulatory review and inspection activities.

17.3.1. Activities to reassess site related factors

The requirement for continuous evaluation of the site for a nuclear installation is set out in Section 49(1) l) and m) of the Atomic Act pursuant to which holders of a licence shall:

- continuously evaluate the facts relevant to the assessment of the acceptability of the site for a nuclear installation and their effect on nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security,
- estimate developments in the facts relevant to the assessment of the acceptability of the site for a nuclear installation with a view to the expected length of the nuclear installation's life cycle.

Monitoring of the site characteristics of a nuclear installation (geological structure, tectonic activity, seismicity, climatic conditions, engineering-geological and geotechnical conditions, hydrogeological conditions, etc.) takes place on a long-term basis since the preparation of the construction of a nuclear installation by the operator and its experts. In addition, competent scientific organizations independently carry out their monitoring and research in these sites so that information on the characteristics of the sites is refined, along with the development of scientific and technical research methods.

Regular re-evaluation of the characteristics of the Dukovany NPP and Temelín NPP sites is submitted to the regulatory body for review, in particular under PSR, which takes place at ten-year intervals (see Chapter 14). The additional evaluation took place, for example, as part of the stress tests performed in response to the accident at the Fukushima Daiichi NPP.

The Final Safety Analysis Reports are updated on an annual basis and publish the latest findings of the evaluation of all the characteristics and phenomena of the sites, in which the two nuclear power plants are located. This area is further reviewed in the context of the PSR (PSR EDU30 and PSR ETE20 took place).

The Temelín NPP site and the potential land for the siting of Temelín NPP Units 3 and 4 were also subjected to detailed examination in 2014 when the Initial Safety Analysis Report was reviewed in detail under the administrative procedure. The PSR for Temelín NPP Units 1 and 2 takes place at present (i.e., for both units in operation).

Similarly, the documentation for Dukovany NPP was updated under the administrative procedure for the continued operation of Units 1 to 4 (2014-2017), which was preceded by PSR.

Requirements for this continuous evaluation meet the principles arising from the VDNS.

17.3.2 Regulatory review and inspection activities

The review activities of the SÚJB (review of safety documentation for both NPPs) are closely related to the inspection activities of the SÚJB, where the description of the state of a nuclear installation in the safety documentation and compliance with the conditions of the issued decisions (see Chapter 17.1.6) is verified directly in the area of the nuclear installation and its surroundings.

Operator experts and SÚJB specialists also monitor the current level of knowledge of various science and actively participate in foreign working groups and activities of WENRA, OECD-NEA and IAEA.

In the case of the SIGMA II project (2016–2022), representatives of ČEZ, a. s., are among the main participating organizations that contribute to the project by creating earthquake catalogues (WP2 – Earthquake Parameters, Action 2.5: Czech Catalogue, Revision of the National Czech Catalogue). Nuclear supervisors in the project are also represented by the SÚJB.

In 2021, Czech experts and SÚJB representatives participated in an expert workshop organized within the SIGMA II and RESIF projects, concerning the evaluation of tectonic faults, their potential activities, and the dating of samples in the survey of these tectonic areas.

17.4. International conventions and arrangements with neighbouring States

This list forms a part of Chapters 7.1.3 and 7.1.4.

Statement on the implementation of the obligations concerning Article 17 of the Convention

National legislation establishes the relevant procedures for assessment of all factors important to the safety of a nuclear installation in relation to its siting and for assessment of its probable environmental impact. At the same time, it applies the regular re-evaluation regime for all important parameters – within the periodic assessment of nuclear safety assurance, while applying the up-to-date technical tools and knowledge and considering any changes, which occurred on the site of a nuclear installation. It also follows that requirements of the legislation were implemented into the practice. The requirements of Article 17 of the Convention are fulfilled in the Czech Republic.

18. DESIGN AND CONSTRUCTION

Each Contracting Party shall take appropriate steps to ensure that:

(i) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defence in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

(ii) the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;

(iii) the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.

Licensing procedures that took place or are under preparation are based on the requirements of the Atomic Act and its implementing regulations, which include IAEA requirements, such as GSR Part-1 (Rev. 1), SF-1, SSR-1, SSR-2/1 (Rev. 1) and SSR-2/2 (Rev. 1) and WENRA recommendations (Safety Reference Levels for Existing Reactors and Safety of New NPP Designs). All the previous design specifications complied with the EUR C Standard, which was used for the request for inquiry procedure for the construction of a new nuclear facility on the Temelín site. Documentation evaluation in the framework of the administrative procedure in the matter of a licence for siting this nuclear facility at the Temelín site showed a capability of an applicant to meet the current requirements, defined in the Principle 1 of VDNS.

As for maintenance and modifications of designs of nuclear installations in operation, the requirements of the Czech atomic legislation and the recommendations of the subsequent safety guides issued by the SÚJB are applied.

In order to achieve safety-related objectives formulated in the Principle 2 of VDNS a systematic and periodic safety review takes place, as described in Chapters 6, 14, and 17. Plant modifications, and enhancements and completions of the instructions for operation and for emergency management are carried out continuously in accordance with the results of the assessment of their safety relevance. The urgent measures, which mostly result from the application of the precautionary principle and from the needs for completing the already created levels of defence in depth on the basis of international experience, were collectively implemented and continuously completed in compliance with the National Action Plan, referred to in Annex 3.

The state of fulfilment of the objectives formulated in the Principle 3 of VDNS is stated, besides this Chapter, in Chapters 6 and 7. The modernization of Czech nuclear legislation was completed in 2017.

18.1 Implementation of defence in depth

18.1.1 Approval procedure for design and construction of nuclear installation

According to the Atomic Act, nuclear installation design means the documented design of a nuclear installation and the procedures and instructions for activities related to the use of nuclear energy in the course of the nuclear installation's life cycle.

The description of the approval procedure of nuclear installation is given in Chapter 7.

As mentioned in Chapter 7, construction of a nuclear installation is one of the activities to which the SÚJB issues an approval in accordance with the provision of Section 9 of the Atomic Act. Pursuant to Section 24 of the Atomic Act, the application for the construction of a nuclear installation shall be provided with the documentation as set out in Annex 1, Part 1 b) of the Atomic Act:

1. management system program,
2. limits and conditions;
3. program of inspections for the construction stage;
4. preliminary safety report;
5. list of selected equipment, including classification of selected equipment into safety classes;
6. list of activities important to nuclear safety and description of the system of education, training and exercises for the personnel, including a description of the qualifications of the personnel;
7. description of the system of training for selected workers;
8. program of construction of the nuclear installation, including the timetable;
9. preliminary commissioning plan for the nuclear installation;
10. preliminary probabilistic safety assessment;
11. preliminary physical protection assurance plan;
12. concept for the safe permanent shutdown of the installation to be licensed, including the method of the radioactive waste management produced;
13. monitoring program;
14. radiation extraordinary event analysis and assessment for the period from the commencement of construction of the nuclear installation to the commencement of decommissioning;
15. on-site emergency plan;
16. establishment of the emergency planning zone;
17. preliminary ageing management program;
18. proof that the financing of the radioactive waste management has been secured, if such waste is generated;
19. evaluation of quality assurance for the preparation of the construction of the nuclear installation;
20. description of the method of quality assurance for construction project implementation;
21. principles of quality assurance for the phases of the nuclear installation's life cycle following construction.

The documentation referred to in points 2, 3, 5, 11, 13, 15 and 16 shall be subject to approval by the SÚJB.

The role of the SÚJB in the licensing procedure is defined by the Atomic Act. Nuclear and technical safety is evaluated and inspected through:

- the inspection activities aimed at observation of the Atomic Act and its implementing regulations;
- the issuance of licences for activities pursuant to Section 9 of the Atomic Act;
- the review and approval of documentation defined by the Atomic Act.

For more information concerning the SÚJB inspection activities in this area see Chapter 14.2.5.

In line with the Principle 1 of VDNS, the applicable national requirements for the whole life cycle of a nuclear installation are laid down in the implementing regulations of the Atomic Act, which are described in detail in Chapter 7. Pursuant to Section 5 of the Atomic Act, anyone who uses nuclear energy shall, among others, as a matter of priority, ensure nuclear safety and radiation protection; precede radiation extraordinary events and, if they occur, minimise their consequences, and act in a way ensuring that the risk to natural persons and the environment is kept as low as can reasonably be achieved taking into account the current state of technical knowledge and all economic and societal aspects.

Section 4(2) a) of the Atomic Act defines nuclear safety as: “the state and capability of nuclear installations and natural persons operating the installation to prevent uncontrolled self-sustaining fission chain reaction or release of radioactive substances or ionising radiation into the environment and to mitigate the consequences of accidents”.

In practice, compliance with all requirements of national nuclear legislation, i.e. compliance with the IAEA recommendations, in particular SF-1 and SSR-2/1 (Rev. 1) and WENRA (Safety of New NPP Designs and Safety Reference Levels for Existing Reactors) is required for the design of a new nuclear power plant in the Czech Republic by the national regulatory body. These requirements were also applied in the framework of the administrative procedure for a licence for siting of Temelín NPP Units 3 and 4, which took place between 2013 and 2021, and Dukovany NPP Units 5 and 6, which took place between 2020 and 2021.

18.1.2 Application of defence in depth and improvement of nuclear safety in design extension conditions

The requirement for the application of defence in depth principle in the context of ensuring nuclear safety using multiple physical safety barriers and applying the safety functions to protect the integrity and functionality of these barriers at the various levels of defence in depth is set out in Section 6 and Section 7 of Decree No. 329/2017 Coll., on the requirements for nuclear installation design. In the context of ensuring compliance with requirements for the application of defence in depth, there is an obligation to ensure prevention and management of abnormal operating conditions, design basis accidents and design extension conditions including severe accident.

Section 5 of the Decree sets out that nuclear installation design shall ensure resistance and protection of a nuclear installation against the risk arising from the occurrence of internal events during operation of a nuclear installation as a result of accidental failure of its systems, structures and components, external events caused by the characteristics of the location for siting of a nuclear installation, human activities, and combination thereof.

Section 7 of the Decree sets out the obligation to ensure, in order to manage design extension conditions, such resistance of a nuclear installation which provides that a severe accident, which could lead to an early radiation accident or a large radiation accident, is a practically eliminated event, i.e. its occurrence is possible to consider as physically impossible or as very unlikely with a high degree of confidence.

Dukovany NPP

Technical data are contained in Annex 2.

The safety criteria and principles on which the original design of the Dukovany NPP was based were included in the Russian technical design – “Technical Justification of Safety”. The design criteria were narrowed down to one basic nuclear safety criterion: “NPP design must provide for the protection of operators and the public from outer and inner irradiation and surrounding environment from contamination by radioactive substances within approved standards. This should be assured both during long-term stable operation and anticipated accident conditions”.

Other criteria were established only implicitly as references to technical standards of the former Soviet Union. The document “Technical Substantiation of Safety” (1974) served as a basis and a series of Czech and Russian normative regulations, which were taken into account when elaborating the original technical design into the particular design of Dukovany NPP, was issued. When comparing the provisions of the above binding regulations during the series of analyses performed for units with the VVER-440/213 reactors at the beginning of the nineties with the contemporary requirements for design documentation, it is possible to state that the Czechoslovak legislation of the eighties was on a very good level. Generally, the requirements conformed to the modern understanding of nuclear safety at that time, and principles and criteria included in the legislation, to a considerable extent, coincide with the current ones.

The state of Dukovany NPP design respects the safety principles of redundancy, diversity and criteria for safe failures to the extent corresponding not only to the requirements at the time of construction , but also at the time of implementation of the significant modifications of equipment as was, for example, a complete replacement of I&C systems. The principles of physical and functional separation are applied in a way that is feasible depending on the options provided by the original design. In view of low core power density and robust construction, the design is characterized by high passive safety.

The Dukovany NPP design considers technical and organizational measures to assure nuclear safety so as not to lose safety function in the event of a single failure of the equipment simultaneously with an undetected long-term unavailability of any other redundant part of the equipment in normal operation. The safety analyses included in the Safety Analysis Reports are performed for the verified set of postulating initiating events.

In connection with the tightening of the international requirements and in response to the international development in the field of safety analyses, a set of analyses of extended design basis conditions has been included in the safety analysis report for Dukovany NPP in the last years. Such analyses consider simultaneous failure of more than one redundant leg of the safety systems or greater damage to higher number of systems, structures and components than it was considered in the original design of the power plant. Complex processes during such events and design potential to cope with the extended design basis conditions are analysed with the use of realistic input assumptions and methods of analysis. The list of analysed events respects the recommendations defined by IAEA, WENRA and the SÚJB Safety Guides.

Temelín NPP

Technical data are contained in Annex 2.

Both Temelín NPP units have been on a level of up-to-date nuclear power plants as to the level of nuclear safety assurance and other characteristics. The basic design of Temelín NPP Units 1 and 2 was elaborated by the Czech design organization Energoprojekt Praha (now part of ÚJV Řež a. s., as the Energoprojekt Praha Division). Already before 1989, the inland experts have analysed and modified the original design. Further technical improvements have resulted from the IAEA expert opinions, the SÚJB recommendations, proposals from the future operator and from many Czech experts and from the results of the External Audit performed by the company Halliburton NUS. Their implementation brought the technical level of Temelín NPP into compliance with western nuclear power plant standards according to requirements of the end of the nineties.

Design changes were then verified and are further verified by new analyses performed with current computer codes in accordance with the requirements of corresponding international standards.

To reach and to maintain the required level of nuclear safety, Temelín NPP was designed to be compliant with generally applicable national regulations and international recommendations for nuclear safety assurance, and fulfils basic safety functions in all operating modes envisaged by the design and conditions of a nuclear installation.

The design applies the principles of redundancy, diversity, criteria for safe failure as well as the principles of physical and functional separation of particular systems at such a high level so as to ensure their adequate reliability. If possible, passive safety functions are used.

The Dukovany and Temelín NPP unit designs respect the concept of defence in depth, as defined in the requirements of the IAEA SSR-2/1 (Rev. 1) and in the WENRA document Safety Reference Levels for Existing Reactors.

In connection with the tightening of the international requirements and in response to the international development in the field of safety analyses analyses have been in the last years carried out, showing the ability of the design to cope with the important scenarios of extended design basis conditions. Complex processes during such events and design potential to cope with the extended design basis conditions are analysed with the use of realistic computational tools, input assumptions and methods of analysis. The list of analysed events respects the recommendations defined by IAEA, WENRA and the SÚJB Safety Guides.

18.1.3 Application of design basis principles

Sections 12 and 29 of Decree No. 329/2017 Coll., on the requirements for nuclear installation design, set out the requirements for nuclear installation design to ensure fulfilment of the principles of the safe use of nuclear energy and reliable performance of the safety functions of systems, structures and components important to nuclear safety, including but not limited to:

- by using passive functions,
- by creating the ability of putting them automatically into a state in which they contribute to the management abnormal operation conditions or accident conditions in a nuclear installation,
- by automatic intervention or intervention on the basis of interventions by operators in accordance with internal regulations,
- by their physical separation and functional isolation, and
- by independence and backing up of systems and by using diversion means.

18.1.4 Safety re-assessment and regulatory activity

In accordance with the Principle 2 of VDNS, continuously are assessed the fundamental documents which demonstrate the safety of nuclear power plants (reports on Periodic Safety Review (PSR), Final Safety Analysis Report with its periodic revisions, documented implementations of the PSR corrective measures program and implementations of measures under the National Action Plan formulated on the basis of the Stress Tests and the Dukovany NPP LTO Project). The requirements for assessment are set out in Decree No. 329/2017 Coll., on the requirements for nuclear installation design (in Sections 24 to 28), and Decree No. 162/2017 Coll., on requirements for safety assessment according to the Atomic Act.

The Final Safety Analysis Reports for Dukovany NPP and Temelín NPP are annually revised in order to keep the documents up to date and with all the incorporated changes in such nuclear installations as well as changes in safety requirements. The requirement for PSR is a condition for a decision on the operation of a nuclear installation and its content is defined by the SÚJB safety guide based on the IAEA Recommendations SSG-25.

Dukovany NPP

First periodic review for the Final Safety Analysis Report for Dukovany NPP took place between 2005 and 2006, and the next one between 2013 and 2014. The findings of such assessments are continuously applied in line with the operator's plan. The National Action Plan for improving nuclear safety of nuclear installations in the Czech Republic was completed on 31 December 2012 and is updated on a continuous basis. The tools used for continuous monitoring and periodic safety re-assessment are described in detail in Chapter 14.1.2.

In the framework of the PSR for Dukovany NPP, the measures were identified and subsequently implemented to increase the resistance of a nuclear installation to occurrence and development of severe accidents with nuclear fuel meltdown. Such measures allow for external cooling of reactor pressure vessel with water and hydrogen removal with the use of newly installed systems. In addition, the building with bubbler pressure limiting device within sealed tightness areas of the containment/confinement and other civil structures were improved to be more resistant to seismic phenomena. Third emergency feedwater pump was installed to increase redundancy in the SG emergency heat removal system. Furthermore, the backup power sources were installed for the case of loss of operation and emergency power supply (station blackout). A backup ultimate heat sink was constructed for the case of serious damage to service cooling towers, which would result in loss of their function; this measure was also recommended under the National Action Plan. I&C systems were completely replaced; sets of updated deterministic and probabilistic safety analyses were created, and other activities aimed at safety enhancement are underway. Under the National Action Plan, the resistance of certain civil structures to extreme climatic phenomena, such as flooding due to torrential rain, was also improved.

Temelín NPP

First periodic review for the Final Safety Analysis Report for Temelín NPP took place between 2008 and 2010, and the next one is underway between 2018 and 2020.

In the scope of the PSR for Temelín NPP, the measures were identified and subsequently implemented to increase resistance of the plant design against the occurrence and development and consequences of severe accidents with fuel meltdown by installing new hydrogen removal systems with higher capacity. A transition to a new fuel with better mechanical properties took place. Furthermore, new cable qualification was carried out. Certain parts of safety-related documentation were revised and some organizational changes were made. Under the National Action Plan, the possibility of direct or indirect cooling of melt nuclear fuel with water during severe accident is being addressed. In the framework of the National Action Plan, certain civil structures were also adjusted to improve their resistance against flooding of the technology due to heavy rains.

18.2 Incorporation of proven technologies

The obligation to use proven method, processes and technologies in the nuclear installation design is directly mentioned in Section 46 of the Atomic Act and the obligation to verify the required characteristics of systems, structures and components important to nuclear safety is then set out in Sections 8 and 9 of Decree No. 329/2017 Coll., on the requirements for nuclear installation design.

The principle of the use of proven technologies in the design and construction of a nuclear installation was always set out in applicable Czech legislation. On the basis of legislation requirements, proven materials consistent with the relevant regulations, technical standards and technical specifications were , used for the design and manufacturing of reactor coolant systems and their components , including reactor pressure vessels in the Dukovany NPP and the Temelín NPP; their sufficient rating was demonstrated by theoretical calculations and experimental verifications, and a reserve for degradation during their operation was considered. The program and methods for the detection of the state of primary circuit were also defined.

Supervision of such activities is within the scope of competence of the SÚJB, which is described in detail in Chapter 8.

Dukovany and Temelín NPPs

Evolutionary designs of power plants with VVER pressurized water reactors, which are used in Eastern Europe and the former Soviet Union, were selected for the Dukovany NPP and the Temelín NPP.

It was verified on a sample of NPP equipment (reactor pressure vessel and steam generator were selected) that the design of nuclear installation sets out the requirements for materials and manufacturing and testing procedures for primary circuit components. In accordance with the legislative requirements (standards) in force at the time of manufacturing and assembly, materials were selected, and manufacturing and testing procedures were defined for this equipment. In the field of the use of materials for nuclear power equipment (including reactor pressure vessels and the rest of the primary circuit), including selection of the most suitable material, it can be stated that all the components of the primary circuit are made from materials with high tensile strength, yield strength, high toughness and resistance to brittle fracture.

An analogous situation exists for steam generators and pressurizers and their materials. All metallic and non-metallic materials used in pressure vessels of steam generators and pressurizers are listed in the accompanying documentation of individual supplies from VÍTKOVICE, a. s., and their detailed listing, chemical composition, mechanical properties, specific properties, method of verifying their quality and other technical data are given in the technical documentation. All technical documents were similarly prepared, as for the reactor pressure vessels, in accordance with the technical standards and legal documents in force at the time of their preparation. Construction materials used in the manufacturing of steam generators and pressurizers are given by Soviet technical design and are based on the relevant parts of the normative-technical documentation purchased by the Czechoslovak party under the contract for the supply of these types of documents concluded with the Soviet party. The production of materials was adopted in the Czechoslovak undertakings or modified for the their production base.

As part of the requirements for modifying the plant configuration, systems and components important to nuclear safety are implemented in accordance with Decree No. 358/2016 Coll., and Decree No. 329/2017 Coll. Proven technologies are preferred even when modifying or adding systems. An example of this approach is the implementation of one of the measures based on experience from the accident at the Fukushima Daiichi NPP, when the C175 type diesel generator of the Caterpillar company was chosen as a backup AC power supply.

The equipment qualification for environmental influences and seismicity was conducted according to the international standards IEC 60780:1998 "Electrical equipment of the safety system - Qualification" and IEEE Std. 323 "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations". According to these standards, qualification may be verified either by type tests or analytical qualification analyses or operating experience based analyses. The procedures based on a combination of operating experience and analyses can also be applied to equipment qualification (e.g. operating experience according to the EPRI manual for qualification: Plant Support Engineering: Nuclear Power Plant Equipment Qualification Reference Manual, Chapter 12). Type qualification testing is the generally preferred method, in particular for electrical and I&C equipment qualification in harsh environment. ČEZ, a. s., has the qualification requirements specified by its own control document for new equipment ordering.

For commissioning of a nuclear installation, the Atomic Act and implementing regulations (Decree No. 21/2017 Coll., on ensuring nuclear safety of a nuclear installation and Decree No. 358/2016 Coll., on requirements for assurance of quality and technical safety and assessment and verification of conformity of selected equipment) require the performance of inactive testing of equipment including a comprehensive functional verification of a nuclear installation and its reviews performed prior to first core, active testing of a nuclear installation, which includes physical and power start-up as well as trial operation of a nuclear installation. Each stage of nuclear installation commissioning is carried out in line with the program prepared in advance in order to verify the function of each individual equipment and behaviour and characteristics of a nuclear installation in specific modes.

18.3 Design for reliable, stable and manageable operation

In addition to the Atomic Act, the conditions for ensuring reliable, stable and manageable operation are elaborated in particular in Decree No. 21/2017 Coll., on ensuring nuclear safety of a nuclear installation. Among others, this Decree sets out the requirements for limits and conditions for maintaining the safety significant physical and technological parameters of a nuclear installation within its operating state (Section 7), and for the processes and activities on a nuclear installation designed to prevent the development of accident conditions and to mitigate their consequences (Sections 26 to 30).

The requirements for the workplaces and systems used to control the nuclear installation, i.e. the requirements for functions and equipment of the main control room and the backup workplace and means for managing a nuclear installation, , are set out in Section 41 of Decree No. 329/2017 Coll., on the requirements for nuclear installation design.

The issues of human factor including supervision of licensees are addressed in Chapter 11.

Dukovany NPP

Over the years, the Dukovany NPP underwent a number of changes made with the objective to minimize the possibility of a human factor error and to improve the man–machine interface in the I&C systems of technological processes. The changes were implemented, or are focused on both the main control rooms and the simplification of regular performance tests of individual installations. From the perspective of the influence of human factor on reliability and safety of operation, the design and the technical equipment of control rooms are of great importance.

The main control room concept in the VVER-440/213 units, in its Dukovany NPP specific modification and renovated within the I&C system refurbishment project, provides fast and easy orientation of the main control room personnel during normal operation as well as during transients. The original situation has been improved further by changes in the instruments ergonomic design implemented as a result of the operating personnel initiative. It also provides easy and fast equipment control from the main control room, timely identification of failures thanks to the appropriate design of the failure and emergency warning systems, and appropriate combination of analogue type signalling and control of the main control room with digital elements – computer based equipment, which is implemented to the main control room. This concerns in particular a set of supporting software facilitating the actual operation of installation, performing auxiliary calculations enabling to utilize the documentation in digitized form, etc.

Temelín NPP

The engineering psychology – ergonomics, which significantly affects the design in terms of the need for complexity of control of many integrated systems, has already been implemented in the design of the HMI (Human–Machine Interface) for the Temelín NPP. The design also takes account of human parameters and technical and other criteria so as to meet the prerequisites for achieving safety-related and operational objectives of the power plant. This particularly concerns the availability of accurate and timely information and the reduction of operator workload. This system approach also includes the maintenance of working environment in control rooms and its physical factors (e.g. lighting, micro climate, noise).

In the framework of the design for replacement of the original design facilities of the I&C system (changeover from the control by means of classical controllers and indicators to the control by means of computer-based control technology), a comprehensive approach in all stages of design and implementation took account, to a maximum possible extent, of the principles of human factors engineering and the requirements and recommendations, contained in particular in international standards ČSN EN 60964 and ČSN IEC 60965.

18.4 Major modifications implemented

Ultimate heat sink at the Dukovany NPP

The requirement for the installation of the ultimate heat sink (KJT) was based on the requirements to improve safety on the basis of post-Fukushima measures. The ultimate heat sink is designed to remove heat from the cooling circuits of the systems important to nuclear safety using the forced-draught towers technology. In addition, it helps to maintain the chemistry of cooling water. The system was put into operation in May 2017.

In connection with inconsistency in coolant flow through the heat exchanger of the emergency core cooling systems (TQ heat exchanger) with the design requirements, the coolant temperature, at which the ultimate heat sink forced-draught towers automatically start, was reduced after consulting the manufacturer. The coolant temperature to start the fans to the low speed and high speed is now 22 C and 26°C, respectively. This modification helps to compensate the coolant flow through the TQ heat exchanger.

Improving fire protection in the Dukovany NPP

Replacement of the electronic fire alarm system (EPS) on the main production unit including extension system.

The electronic fire alarm systems (EPS) ensure detection and signalisation of fire anywhere on the main generating unit to the main control room. The EPS replacement project began in 2016 due to the termination of support to the original system by its manufacturer and due to equipment obsolescence. The EPS system was replaced on whole main production unit in 2017 and the members of the system were interconnected in the so-called “circle” where the failure of one circle does not cause loss of the operability of the others. The project was completed in 2017.

Reconstruction of the fixed fire extinguishing system fin cable channels of the main generating unit.

The fixed fire extinguishing system ensures liquidation of any fire in the area of cable channels of safety significant cables, which provide power supply to the selected equipment. The project was commenced during 2016 due to the end of life of the original equipment and the need to eliminate the threat of corrosion of the fire extinguishing system. The original fire extinguishing system used the water mist spraying technology. Operating experience with this system has shown risk of potential clogging of the spray nozzles due to corrosion products of the pipeline. It was therefore decided to exchange the dry powder extinguishing material for the existing fixed fire extinguishing system. This modification provides increased efficiency of fire extinguishing and reduces the side effects of extinguishing agent on the safety significant cables not affected by fire. The project is implemented on a long-term basis.

Installation of third pump for cooling the spent fuel pool

The addition of another pump to the existing two systems TG11, TG12 increases the resistance to single failure of the systems of normal removal of residual heat of the spent nuclear fuel pool. This avoids the risk of using the emergency method of coolant boiling inside the spent nuclear fuel pool and injection to maintain a constant level resulting in leakage of activity together with steam into the reactor hall and possibly further into the environment. The installation on all reactor units was completed in 2020.

Implementation of new technical requirements in the physical protection system of Dukovany NPP and Temelín NPP

The resilience of the physical protection of Dukovany NPP and Temelín NPP was increased. The revitalisation of the physical protection system was performed to meet the requirements of current legislation and in particular according to the requirements of the new Atomic Act. New boundaries have been built for vital areas, which are subject to a stricter entry regime and only for persons qualified for security. The implemented set of all measures eliminated the risk of intentional damage to systems and equipment important to nuclear safety. Implementation at both sites (Dukovany NPP and Temelín NPP) was completed in 2020.

Replacement of the bodies of pressurizer safety valves and ensuring the removal of hydrogen from the pipeline of the pressuriser node at the Temelín NPP

This modification was introduced on both generating units of the Temelín NPP. The aim of the implementation of the modification was to improve the nuclear safety by ensuring the removal of hydrogen from the pipelines and pressurizer body while actuating the safety valves. A new hydrogen removal pipeline was implemented as part of this modification. In connection with the installation of drain piping, the bodies of pressurizer safety valves had to be replaced. Work was completed in 2018.

Statement on the implementation of the obligations concerning Article 18 of the Convention

The legislation valid in the Czech Republic and its implementation in practice is compliant with the requirements of Article 18 of the Convention as well as the VDNS principles. The operated systems, structures and components at the Dukovany NPP and the Temelín NPP are designed with respect to the defence-in-depth concept against radioactive substance release with the goal to prevent occurrence of radiation accidents and to mitigate their radiological consequences. Applied technologies are well proven on a long-term basis and their performance and reliability are continuously verified by the tests combined with analyses. The designs of nuclear installations fulfil the current requirements for reliability and easy control from the perspective of human factor.

19. OPERATION

Each Contracting Party shall take appropriate steps to ensure that:

(i) the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning program demonstrating that the installation, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from the safety analyses, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;

(iii) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;

(iv) procedures are established for responding to anticipated operational occurrences and to accidents;

(v) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;

(vi) incidents significant to safety are reported in a timely manner by the holder of relevant licence to the regulatory body;

(vii) programs to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;

(viii) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned both in activity and in volume, and in necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

19.1 Description of approval process including summary of national legislation

The requirements for the commissioning of nuclear installations in the Czech Republic as well as for all stages of their operation are laid down to avoid an accident with radiological consequences and in the case of its occurrence, to mitigate the consequences of such an accident, which follows the main objective and principles of the VDNS.

The description of the approval process, in general for siting, designing and construction, operation and decommissioning of nuclear installation is given in Chapter 7.

The legal framework for approval of the operation of a nuclear installation from the nuclear safety and radiation protection point of view is established by the Atomic Act and its implementing decrees, in particular:

- ***Decree No. 361/2016 Coll.,*** on security of nuclear installation and nuclear material.
- ***Decree No. 21/2017 Coll.,*** on ensuring nuclear safety of a nuclear installation.
- ***Decree No. 422/2016 Coll.,*** on radiation protection and security of a radioactive source.
- ***Decree No. 359/2016 Coll.,*** on details of ensuring radiation extraordinary event management.
- ***Decree No. 377/2016 Coll.,*** on the requirements for the safe management of radioactive waste and on the decommissioning of nuclear installations or category III or IV workplaces.

- ***Decree No. 358/2016 Coll.,*** on requirements for assurance of quality and technical safety and assessment and verification of conformity of selected equipment.
- ***Decree No. 408/2016 Coll.***, on management system requirements.
- ***Decree No. 162/2017 Coll.,*** on requirements for safety assessment according to the Atomic Act.
- ***Decree No. 329/2017 Coll.***, on the requirements for nuclear installation design.

As further mentioned in Chapter 3.1.2, commissioning and operation of a nuclear installation are activities for which the SÚJB authorization is required under the provision of Section 9 of the Atomic Act as to nuclear safety, radiation protection, technical safety, emergency preparedness, and security.

Commissioning

An application for the issue of authorization for the individual stages of nuclear installation commissioning must be, in accordance with Sections B, C, D, and E of Annex to the Atomic Act, accompanied by the following documentation:

a) For construction stages of a nuclear installation:

1. management system program,
2. limits and conditions,
3. program of inspections for the construction stage,
4. preliminary safety report,
5. list of selected equipment, including classification of selected equipment into safety classes,
6. list of activities important to nuclear safety and description of the system of education, training and exercises for the personnel, including a description of the qualifications of the personnel,
7. description of the system of training for selected workers,
8. program of construction of the nuclear installation, including the timetable,
9. preliminary commissioning plan for the nuclear installation,
10. preliminary probabilistic safety assessment,
11. preliminary physical protection assurance plan,
12. concept for the safe permanent shutdown of the installation to be licensed, including the method of the radioactive waste management produced,
13. monitoring program,
14. radiation extraordinary event analysis and assessment for the period from the commencement of construction of the nuclear installation to the commencement of decommissioning,
15. on-site emergency plan,
16. establishment of the emergency planning zone,
17. preliminary ageing management program,
18. proof that the financing of the radioactive waste management has been secured, if such waste is generated,
19. evaluation of quality assurance for the preparation of the construction of the nuclear installation,
20. description of the method of quality assurance for construction project implementation, and
21. principles of quality assurance for the phases of the nuclear installation's life cycle following construction.

b) For the first loading of nuclear fuel into a reactor (physical start-up):

1. management system program,
2. limits and conditions,
3. in-service inspection program,

4. final safetyanalysis report for the first physical start-up of a nuclear installation with a nuclear reactor,
5. list of selected equipment, including classification of selected equipment into safety classes,
6. list of activities important to nuclear safety and description of the system of education, training and exercises for the personnel, including a description of the qualifications of the personnel,
7. description of the system of training for selected workers,
8. neutron-physical characteristics of the nuclear reactor core,
9. certificate of successful completion of construction and certificate of readiness of the installation, personnel and internal regulations for the next phase of the nuclear installation’s life cycle,
10. physical start-up program, including the timetable,
11. probabilistic safety assessment,
12. physical protection assurance plan,
13. statement that all checks of radiation extraordinary event response preparedness in the emergency planning zone under Section 156 (2) c) through g) of the Atomic Act have been conducted,
14. pre-operational ageing management program,
15. document demonstrating that safe radioactive waste management has been ensured, including the financing thereof, if radioactive waste is generated,
16. assessment of the quality of selected equipment,
17. emergency operating procedures, and
18. severe accident management guidelines.

c) For stages following the first nuclear fuel loading into the reactor: (power start-up):

1. management system program,
2. limits and conditions,
3. in-service inspection program,
4. final safety analysis report,
5. list of selected equipment, including classification of selected equipment into safety classes,
6. list of activities important to nuclear safety and description of the system of education, training and exercises for the personnel, including a description of the qualifications of the personnel,
7. description of the system of training for selected workers,
8. neutron-physical characteristics of the nuclear reactor,
9. certificate of successful completion of the first physical start-up and certificate of readiness of the installation, personnel and internal regulations for the operation of the nuclear installation,
10. program for the first power-generation start-up of a nuclear installation with a nuclear reactor and trial operation, including the timetable,
11. probabilistic safety assessment,
12. physical protection assurance plan,
13. operational ageing management program for the first power-generation start-up and trial operation of a nuclear installation with a nuclear reactor,
14. document demonstrating that safe radioactive waste management has been ensured, including the financing thereof, if radioactive waste is generated,
15. statement on verification of the expiry date of iodine prophylaxis antidotes distributed in accordance with Section 156(2) d),
16. emergency operating procedures, and
17. severe accident management guidelines.

After a positive evaluation of the above-mentioned documentation, the SÚJB issues the approvals for the individual phases of the reactor commissioning, whilst the program of the phases, proposed security method, changes in security assurance, proposed decommissioning method, on-site emergency plan, in-service inspection program, as well as the Limits and Conditions for safe operation of a nuclear installation, are subject to separate approval by the SÚJB.

Operation

Application for issuing the authorization for the nuclear installation operation must be, in accordance with Appendix F to the Atomic Act, accompanied by the following documentation:

1. management system program,
2. limits and conditions,
3. in-service inspection program,
4. final safety analysis report,
5. list of selected equipment, including classification of selected equipment into safety classes,
6. neutron-physical characteristics of the nuclear reactor core,
7. list of activities important to nuclear safety and description of the system of education, training and exercises for the personnel, including a description of the qualifications of the personnel,
8. description of the system of training for selected workers,
9. certificate of readiness of the installation, personnel and internal regulations for the operation of the nuclear installation,
10. evaluation of the results of the first power-generation start-up of a nuclear installation with a nuclear reactor,
11. evaluation of the results of trial operation if this is the first licence for the operation of a nuclear installation,
12. operational program, including the timetable,
13. probabilistic safety assessment,
14. physical protection assurance plan,
15. decommissioning plan,
16. estimation of decommissioning costs,
17. operational ageing management program,
18. document demonstrating that safe radioactive waste management has been ensured, including the financing thereof, if radioactive waste is generated,
19. emergency operating procedures, and
20. severe accident management guidelines.

After a positive evaluation of the above-mentioned documentation, the SÚJB issues the authorization for nuclear installation, whilst changes in the documentation, approved in previous stages, are subject to a separate approval by the SÚJB.

The licence for operation is not time limited by law.

19.2 Operational limits and conditions

The establishment of the Limits and Conditions for safe operation is required by the existing legislation – the Atomic Act and a set of its implementing legislation, as one of the basic documents for issuing authorization of the first nuclear fuel loading into the reactor and for subsequent operation of the nuclear installation.

The requirements of the Limits and Conditions for safe operation have been formulated as early as 1982, following an initiative of the regulatory body. The concept was based on the US NRC reference guide “NUREG 1431” for nuclear power plants with pressurized water reactors.

The Limits and Conditions for safe operation form a set of uniquely defined conditions, for which it has been proved that the operation of nuclear installation is safe. Classification of the Limits and Conditions for safe operation is established in Decree No. 21/2017 Coll., and includes the following data categories:

- Safety limits.
- Protection systems setting.
- Limiting conditions (requirements for operation ability and acceptable values of parameters).
- Checking requirements.
- Organizational measures.
- Justification for the Limits and Conditions.

Limits and Conditions establishes the values of physical and technological parameters directly affecting the condition of physical barriers, which prevent the leakage of radioactive substances, the setting of protection systems and the requirements for operation ability of equipment important from a nuclear safety point of view.

In case any deviation from the Limits and Conditions occurs during the operation, responsible persons shall take immediate measures to restore compliance as soon as possible. If the compliance cannot be restored and possible consequences of the deviation are significant for nuclear safety, the reactor must be put into such a state, in which the respective requirements of the Limits and Conditions do not apply. The operator is obliged to inform the SÚJB of all deviations from the requirements of the Limits and Conditions, subsequently an analysis of the Limits and Conditions violation is performed and measures preventing the repetition of such events are proposed.

Implementation and documentation of the Limits and Conditions, training in the Limits and Conditions and their availability to the installation personnel involved in the safety related activities; review and revision of the Limits and Conditions as required.

The Limits and Conditions are intended for normal and abnormal operation and take precedence over all operating regulations addressing the operating conditions of normal and abnormal operation. Should a nuclear installation be in the condition where termination of such conditions requires the application of special procedures (Elimination of Abnormal Conditions, Elimination of Extraordinary Conditions, Elimination of Failure Conditions), failure to achieve the values of safety limit is the priority in terms of the Limits and Conditions. The Limits and Conditions are documented in the structure of operating regulation; the availability to personnel follows the same rules as the availability of operating regulations (see Chapter 19.3). Operating personnel is regularly trained in the area of the Limits and Conditions as part of training days.

Limits & Conditions for the Dukovany NPP

The first version of the Limits and Conditions for the Dukovany NPP units was elaborated in following the US NRC reference guide [14-1]. Since that time, the Limits and Conditions have been continuously developed and details modified. The Limits and Conditions were revised following an issue of the amended Atomic Act. These Limits and Conditions were put into force in 2001. The NUREG 1431 document was considered account during the revision.

The document is kept updated depending on executed modifications and in compliance with the latest results of research and development and with the application of experience in operating of particular NPP units.

The requirements of the Limits and Conditions are based on the prerequisites and results of safety analyses, documenting the power plant safety at operating states and accident conditions (deterministic approach) and, when the limited technological system operation ability recovery time is fixed, they take the PSA results into account. The Limits and Conditions also reflect the calculation and experimental analyses and data and are based on operating experience not only from the Dukovany NPP units with the VVER 440/213 reactors, but also from similar units in other countries (the Slovak Republic, Hungary, and the Russian Federation).

Contents and internal segmentation of the Limits and Conditions are compliant with the requirements of the Atomic Act and Decree No. 21/2017 Coll. Justification of the Limits and Conditions are an integral part thereof. The Limits and Conditions are directly approved by the SÚJB and are also part of the Final Safety Analysis Report.

Limits & Conditions for the Temelín NPP

The Limits and Conditions for the Temelín NPP were elaborated following the NUREG 1431 document and their requirements are based on the prerequisites of safety analyses, documenting the plant safety at abnormal and accident conditions. Contents and internal segmentation of Temelín NPP Limits and Conditions are compliant with the requirements of the Atomic Act and Decree No. 21/2017 Coll. The Limits and Conditions for the Temelín NPP are part of the Final Safety Analysis Report. The Limits and Conditions were approved by the SÚJB as a separate document within the administrative procedure for the issue of authorization for the first fuel loading into the reactor core. Limits and Conditions documentation, which is used by the plant personnel, is composed of two parts:

1. Limits and Conditions for safe operation.
2. Justification of the Limits and Conditions for safe operation.

From the first fuel loading into the reactors of both units the approved Limits and Conditions were during the commissioning and the trial operation, and now also in operation, several times modified with the changes approved separately. The necessity of performing these changes resulted from the performed approved equipment modifications and the operating experience.

The revision of the whole document is executed periodically including justification of the Limits and Conditions.

19.3 Procedures for operation, maintenance, inspections and testing of a nuclear installation

Basic legal framework

The legislative requirements for holders of a licence are set out in the Atomic Act and its implementing regulations. The requirements for the existence of regulations and the obligation of licence holders to act in compliance therewith arise directly from the Atomic Act or the Decree on the requirements for nuclear installation design.

The regulations are divided into regulations for normal operation, regulations for abnormal operation, regulations for design basis accident conditions of a nuclear installation (symptom-oriented), regulations for the ensuring and recovery of critical safety functions as well as beyond design-basis accident management guidelines (Severe Accident Management Guidelines/Severe Accident Control Room Guidelines – SAMG/SACRG).

The specific requirements are set out in Decree No. 21/2017 Coll.:

1. For maintenance, tests and inspections of selected equipment and the systems, structures and components relevant to nuclear safety, which are not the selected equipment, during commissioning or operation of a nuclear installation, documented procedures shall be implemented to ensure their reliability and functionality in line with the design of a nuclear installation.

2. Maintenance, tests and inspections under paragraph 1 shall be carried out at intervals ensuring identification of the damage of selected equipment and the systems, structures and components relevant to nuclear safety, which are not the selected equipment, before they can fail.
3. Data on maintenance, tests and inspections pursuant to paragraph 1 shall be recorded, retained and assessed in order to obtain information about failure of selected equipment and the systems, structures and components relevant to nuclear safety, which are not the selected equipment. Where such failure is revealed
    a) corrective maintenance shall be carried out, and
    b) the preventive maintenance program shall be adjusted to avoid similar failure from now on.
4. The scope and frequency of preventive maintenance, tests and inspections of selected equipment and the systems, structures and components relevant to nuclear safety, which are not the selected equipment, shall be determined based on their
    a) relevance to nuclear safety,
    b) reliability and recommendation of the supplier of these systems, structures and components, and
    c) experience and results of the monitoring of operating conditions of these systems, structures and components.
5. The scope and frequency of preventive maintenance, tests and inspections of selected equipment and the systems, structures and components relevant to nuclear safety, which are not the selected equipment, shall ensure their reliability and functionality.
6. After maintenance, inspection or modification, the condition of selected equipment and the systems, structures and components relevant to nuclear safety, which are not the selected equipment, shall be assessed, documented and verified by functional test under a predetermined program before being put back into operation.
7. Repair of selected equipment and the systems, structures and components relevant to nuclear safety, which are not the selected equipment, shall be carried out so as to ensure a reasonably achievable level of nuclear safety of a nuclear installation in the course of repair.

Introduction of operating procedures, their implementation, periodic review, modification, approval and documentation; integration of operating procedures into the management system in a nuclear installation

The set of management system documents of ČEZ, a. s., is structured as follows:

- Strategic documents (statutes, visions, strategies, policies, documents of the bodies of the company).
- Managing documents (documents that are the management instrument of strategic and top management, or project managers – decision of the Board of Directors, order of the director, management manual, guidelines, procedures, etc.).
- Regulatory documents – documents setting out the limitations, requirements and recommendations for processes, activities, designs, resources, systems, technologies and equipment (standard and technical standard).
- Working documents (methodology, rules of operation, traffic rules, training program, description of qualification, documents for the provision of services, operating documents, documents relating to equipment, etc.).
- Working outputs (documents for demonstration, design documentation, records, drawings, contracts, correspondence, etc.).

Operating procedures are included in the “Working Documents” group. Operating procedures are controlled documents, i.e., they are registered and their life cycle is implemented according to the predefined requirements. They are categorized regarding to nuclear safety and are assigned the appropriate level of confidentiality.

The form of the development of operating procedures is prescribed by an administrative regulation, which sets out the type contents of operating procedures and the requirements for the terminology used, use of the official design symbols, abbreviations and units of measurement. The rules for the use of verbs for activities, rules for the introduction of warnings, alerts and notices are also set out. User friendliness, uniform structure, unambiguity, and clarity are highlighted.

Operating procedures are periodically verified and reviewed by the expert guarantor of the document during use, in terms of factual accuracy, up-to-date nature and necessity, and maintained in accordance with the results of the review. The specific date is registered in the information system when the review was conducted and the deadline for the next review. If the result of the review found that changes have occurred that have made the preparation of a new revision necessary, the expert guarantor shall immediately take action to prepare it.

The current revision of the operating procedure can be amended/modified by amending the operating procedure. The amendment must be assigned to a specific operating procedure and applies to the particular revision. It is subject to the same commenting, recommendation and approval procedure as the basic degree. The amendment shall be prepared in the form of replacement sheets and should be uniquely able to be included in the operating procedure. To approve the operating procedures, the control documentation sets out a table of responsibilities and expert guarantors, their superiors and other recommending and approving persons are appointed by professional roles for individual groups of operating documents.

Operating procedures are registered electronically in the information system and a paper original is archived following the Archiving and Discarding Order in the documentation management centre. All documents are marked with an identification code/number that is unique and non-interchangeable.

Availability of procedures to competent nuclear installation staff

Operating procedures are available to nuclear installation staff at the point of operation. Current documentation is available at all points of operation to the extent determined by the applicable distribution list for the point of operation. Permanent presence and availability of a complete and updated set of procedures, including limits and conditions, in both electronic and printed form, are ensured in control workplaces. Currently issued documents are distributed in a controlled manner to the employees concerned. A system of a written acknowledgement of the receipt of the operational documentation has been created. Withdrawal of superseded/invalid revision takes place along with the distribution.

Involvement of competent nuclear installation staff in the development of procedures

Staff involved in the creation, assessment and approval of operating documentation, including revisions, have the associated roles defined, are competent for such activities and have access to information that they can use as a basis for their decisions.

The main control room staff is involved in the creation of operating procedures in the role of authors of manipulation parts and participates in commenting on operating procedures. Each operating procedure is recommended or approved by the executive staff of the Operations Management Unit and the executive employee of the Operations Management Unit is the expert guarantor for the manipulation part. The issues of user friendliness of operating documents are also considered under these activities.

Main control room staff is involved in the review and updating of procedures prior to their implementation also from the perspective of human factors and ergonomics of the activities carried out based on detailed knowledge of the points of operation and the activities that are performed in these workplaces.

19.4 Procedures for responding to anticipated operational failures and accidents

The implementing regulations require the licence holder to have individual sets of internal regulations for normal operation, abnormal operation and accident conditions. The regulations for abnormal operation are event-oriented and the regulations for accident conditions are symptom-oriented. Furthermore, Decree No. 21/2017 Coll., on ensuring nuclear safety of a nuclear installation requires:

Processes and activities to prevent the development of accident conditions in a nuclear installation and to mitigate their consequences

Section 26

1. In the processes and activities to prevent the development of accident conditions in a nuclear installation and to mitigate their consequences (hereinafter referred to as the "accident management system")
    a) objectives shall be set and strategies shall be implemented for accident conditions management, which are based on safety assessment and on design requirements for a nuclear installation,
    b) a set of measures shall be implemented for accident conditions management in line with the objectives and strategies for accident conditions management, which shall include
        a. technical measures for accident conditions management, including means to obtain and transmit information on a nuclear installation, and
        b. organisational measures for accident conditions management,
    c) the documentation package shall be created and maintained for accident conditions management,
    d) staff ensuring accident conditions management shall be trained in accident conditions management, and
    e) analyses shall be undertaken to develop the strategies for accident conditions management and the results of such analyses shall be used for this development.
2. The accident management system shall
    a) allow for management of accident conditions in a nuclear installation initiated in all conditions of a nuclear installation,
    b) allow for management of accident conditions encountered in all nuclear installations situated in the same area for siting of a nuclear installation at once,
    c) allow for management of accident conditions, during which a nuclear reactor and an irradiated nuclear fuel storage pool are affected at once,
    d) include rules for the mutual support among nuclear installations with a nuclear reactor situated in the same area for siting of a nuclear installation for accident conditions in one of them in order not to compromise the nuclear safety of a nuclear facility fulfilling the supporting function,

e) include an effective link to radioactive waste management or remedy of the situation following a radiological emergency for the area affected by radiological emergency or for its part in order to mitigate the consequences of accident conditions, and

f) take account of

I. foreseen environmental conditions including extensive damage to internal or external infrastructure and expected degraded conditions, including radiation conditions, which can be encountered during accident conditions,

II. initiating events or phenomena, which can cause accident conditions, and

III. human resources and impact of human factor on accident conditions management.

Section 27

1. The documentation package for accident conditions management shall contain
   a) emergency operating procedures,
   b) severe accident management guidelines, and
   c) other documents for accident management, in particular
      I. documentation for management of extensive damage to the area for siting of a nuclear installation, and
      II. procedures for the use of alternative means for accident conditions management.
2. The documentation package for accident conditions management shall enable the staff ensuring accident conditions management
   a) to set the priorities for the activities involved in accident conditions management, and
   b) to carry out activities in environmental conditions that can be encountered under accident conditions.
3. The documentation package for accident conditions management shall
   a) be created in a systematic manner, take account of a particular nuclear installation and correspond to the current design of a nuclear installation,
   b) be internally and mutually coherent, and include links for transition among individual emergency operating procedures and severe accident management guidelines, and
   c) take into account the uncertainties in the knowledge of the time course and severity of physical phenomena, which can be encountered in the course of accident conditions in order to carry out the activities during accident conditions management in a way to meet the required objectives.
4. The documentation package for accident conditions management shall be verified in terms of efficiency and ability to ensure accident conditions management prior to the start of power start-up and operation of a nuclear installation.
5. During operation of a nuclear installation, permanent presence and availability of the complete and updated documentation package for accident conditions management shall be ensured in control rooms.

Section 28

1. The emergency operating procedures shall
   a) establish rules providing for management of design basis accidents and instructions for recovery of a nuclear installation,
   b) establish rules providing for management of extended design basis conditions except for severe accidents and instructions for recovery of safety functions or replacement of their loss,

c) ensure prevention of severe accident,
d) enable the staff to respond to an event without its accurate identification only by the symptoms, which are the values of safety parameters and the status of basic safety functions,
e) be based on realistic and nuclear installation specific analyses conducted for this purpose,
f) enable the staff to immediately recognise the accident conditions for which they are intended, and
g) contain initial conditions for the application of the procedure corresponding to the event occurred and initial conditions for departure from that procedure.

2. The severe accident management guidelines shall
   a) enable to respond to an event without its accurate identification only by the symptoms, which are the values of safety parameters determining the condition of physical safety barriers,
   b) ensure the limitation of development and the mitigation of the consequences of severe accident, and
   c) set the strategies for emergency management and physically identifiable mechanisms endangering physical safety barriers that were identified during analyses of severe accidents, regardless of their likelihood.
3. The following shall be examined in the verification and validation of emergency operating procedures and severe accident management guidelines
   a) applicability in the foreseen environmental conditions and in terms of the human resources available, and
   b) efficiency of taking account of the impact of human performance.
4. A full-scope plant simulator shall be used for the validation of emergency operating procedures.
5. The validation of emergency operating procedures shall be based on representative scenarios of accident conditions.

Section 29

1. The accident management system shall be regularly and following the special safety assessment in case of a radiological emergency in a nuclear installation or any other nuclear installation of similar type reconsidered and, where appropriate, updated in order to ensure that
   a) it is consistent with the current level of science and technology, and operating experience, and
   b) the emergency operating procedures and severe accident management guidelines are consistent with the current state of a nuclear installation to the extent allowing for the application of the strategies for accident conditions management.
2. The results of the verification and validation of emergency operating procedures and severe accident management guidelines prior to implementation of a new strategy for accident conditions management or a fundamental change to the existing strategy for accident conditions management shall be incorporated into the emergency operating procedures and severe accident management guidelines.

Section 30

1. Training and periodic exercises shall be ensured in the accident management system in the field of the application of emergency operating procedures and severe accident management guidelines by personnel involved in accident conditions management.
2. A full-scope plant simulator shall be used for the training and periodic exercises in the field of the application of emergency operating procedures.
3. A simulation tool shall be used for the training and periodic exercises in the field of the application of severe accident management guidelines, which enable modelling the courses of different scenarios of severe accidents.
4. Periodic exercises shall be ensured in the accident management system in the field of the transition in the application of emergency operating procedures and severe accident management guidelines with the use of a full-scope plant simulator.
5. Periodic exercises shall be ensured in the accident management system in the field of the interventions provided for by emergency operating procedures and severe accident management guidelines necessary for the recovery of safety functions, including those consisting in the application of alternative technical means or facility situated outside the premises of a nuclear installation. The potential unavailability of measuring devices, lighting and electrical energy, and the use of personal protective equipment shall be taken into account in the periodic exercise of these interventions.

An Accident Management Program, which is jointly managed for both NPPs, is implemented for anticipated failure and accident management. The Accident Management Program contains a package of adopted strategies, plans, measures and activities, which ensure that the state of technology, documentation and personnel responsible for their fulfilment is at the sufficient level and is ready to carry out the efficient interventions to prevent, or mitigate the consequences of accident conditions at the NPP.

Implementation of the requirements of the Accident Management Program constitutes a functional system for accident prevention and mitigation of accident consequences (intervention management and performance), which minimizes any undesired personnel errors and equipment failures in connection with the occurrence and course of accident conditions at the NPP. The Accident Management Program incorporates the execution of the inspections focused on quality and the status of implementation of this control documentation and the status of implementation of technical measures for mitigation of consequences of such accidents.

To manage anticipated failures and accidents at both NPPs, AOPs and EOPs were developed and implemented in the framework of the Accident Management Program.

For abnormal conditions due to minor leaks, equipment failures, losses of auxiliary systems, etc., the relevant AOPs are prepared for both NPPs. The AOPs are divided by equipment, the loss or failure of which causes a failure state (failures on the part of the primary circuit, failures on the part of the secondary circuit). Another group of AOPs deals with the failures on power supply including failures of blackout or island operation type. Prepared are also AOPs, which deal with the threat to or loss of equipment due to floods or fires. The AOPs also contain the procedures for personnel activity during extreme climatic conditions and effects of seismic phenomena, associated both with an immediate change in unit power, and deal with the conditions during which the power level is not automatically reduced, but the solution of which can require, after a certain period, to shut down particular systems, or unit shutdown and cooldown.

The AOPs type regulations are event-oriented, i.e., each procedure deals with a particular identified failure state on equipment. The exception is the regulation P002a – Losses of Primary Circuit and Secondary Circuit. This procedure deals with lesser losses, during which the conditions for the application of emergency procedures (EOP) have not yet been met. This procedure is closely linked to EOPs and is, as the EOPs, symptom based.

Symptom based emergency operation procedures (EOPs) for power states were developed and implemented to support main control room personnel in dealing with accident conditions in unit operation. Either the automatic or manual reactor trip or start of the safety systems is an input condition for the start of the activities in accordance with the Emergency Operating Procedures.

EOPs were developed in 1994–1998, verified and validated by 2000, and implemented in 1999 at Dukovany NPP and in 2000 in case of Temelín NPP. The revisions of EOPs are executed in a systematic manner depending on equipment modifications implementation in Dukovany NPP and Temelín NPP.

The package of the EOP strategies includes a wide range of events within the accident conditions – ranging from design basis accidents to possible combinations of events, including multiple breaks and equipment failures. Emergency Procedures include in accordance with the PSA Level 1 study, all relevant scenarios, which might lead, with a certain probability, to the core damage. Interventions of the main control room operators are focused on the prevention of reactor core damage and are always in compliance with the requirements for prevention or minimization of the consequences of potential radioactivity release to the environment.

The Symptomatic-oriented Emergency Operating Procedures deal with accident conditions of the NPP according to their symptoms, i.e., independently on events. Monitoring of the critical safety functions is an integral part of the procedures. All emergency states are always resolved until the so-called safe condition when a nuclear unit is fully under the operator's control, permanent subcriticality and core heat removal are ensured; in most cases of leaks, the unit is cooled down to cold condition by following the relevant regulation.

The employees with a long-term professional practice in the operation of the units were involved in the preparation of symptomatically oriented emergency procedures. Individual stages of the new operational Procedure development were subject to verification both by Westinghouse personnel and by the personnel of the main control rooms of particular units. A study of the human factor response in the application of the Procedure has been prepared. The emergency procedures were validated at a simulator. The use of the procedures for abnormal and accident conditions is regularly trained at a full-scale simulator.

The Emergency Operating Procedures (EOPs) are currently updated on regular basis using changes in design, comments arising during simulator training and especially comments arising from the long-term Westinghouse contract (the so-called "Maintenance program"). Annual meetings of the Procedure authors and Westinghouse employees are held to discuss significant comments and proposals from the NPP side and, at the same time, the Westinghouse Company discusses with the NPP personnel approved changes in generic instructions. Approved changes are after validation included into the Emergency Procedures. Extensive causative documentation, the so-called "Basis", forms an integral part of the Emergency Procedures.

The Emergency Procedures are also accompanied by a list of the reference analyses, which served as an input for the development of the Procedure and a list of analyses, which were used for the procedures validation, including their changes.

The procedure for failure condition solutions (Shutdown EOPs) was created for non-power reactor modes. The PSA results for non-power conditions (Shutdown PSA) were used as background material for the creation of this Procedure. The Procedure amends the EOPs so that all operating modes, including outage and refuelling are covered.

In 2009, a set of emergency procedures was completed with the documents (TPS manuals), intended for members of the Technical Support Centre for the cases where the support of the main control room in the use of EOPs is required.

In the framework of the Accident Management Program, units are also gradually improved regarding severe accidents. In line with the good practice and international recommendations, the Severe Accident Management Guidelines (SAMGs) were developed and issued at both power plants in 2004.

The SAMGs are symptom-based structured guidelines for selection of appropriate strategy for mitigation of accident with fuel meltdown based on the current state of the unit. In line with SAMG philosophy, personnel activity is aimed at the prevention of containment integrity loss, prevention of further development of severe accident and minimization of radioactive releases to the environment. Activities according to the SAMGs are managed by the Technical Support Centre and the Emergency Response Board until the affected unit will be put into long-term stable condition, i.e., when the whole nuclear unit is under control, containment integrity and melt heat removal are ensured.

Specific criteria are defined for the transition from EOPs to SAMGs. The SAMGs also contain the procedures to support the primary activities carried out by main control room personnel until the permanent management of activities will be taken over by the Technical Support Centre and the Emergency Response Board. The validation of SAMGs is in case of both power plants executed by means of selected validation analyses demonstrating a proper selection of strategies and helpful for optimisation of some of their aspects. In 2012, SAMGs were completed with the Chapters for limiting the consequences of severe accidents, which would occur during outages of units, i.e., mainly those states when the reactor is open, as well as guidelines for severe accidents, which would occur in the spent fuel storage pool.

Use of AOPs, EOPs, SAMGs, contained strategies and phenomena in severe accidents are the subject of the training of expert personnel of the main control room, the Technical Support Centre and the Emergency Response Board, and are practiced during emergency exercises.

The application of all new instruments was incorporated into all emergency procedures including SAMGs, which were implemented within the post-Fukushima measures, in particular new stable station blackout diesel generators and mobile diesel generators as well as other diverse and mobile instruments intended for basic safety functions, in particular during multi-unit events. Such new instruments and complemented procedures make it possible to deal with the so-called “Extensive Loss of AC Power” and the so-called “Loss of Ultimate Heat Sink” including their combination. All the regulations are interlinked to the application of developed DAM Guides, analogous to the FLEX Guides in the USA.

An EDMG (Extensive Damage Mitigation Guideline) procedure was prepared to deal with the extensive site damage associated with the loss of site management and control. The purpose of the EDMG is to restore site control and management abilities, set the priorities, coordinate all rescue and restoration works, including ensuring of the safety functions of all units on the site.

The employees with a long-term professional practice in the operation of the units were involved in preparation of all emergency procedures. Individual stages of the development of new procedures were subject to verification both by Westinghouse personnel and by the personnel of the main control rooms of particular units. A study of the human factor response in the application of the procedures has been prepared. The emergency procedures were validated at a simulator. The procedures are regularly validated at a full-scale simulator. Single procedures are also validated whenever equipment modifications or changes in procedure strategy are made. All procedures are further supported by best-estimated analyses. The use of the procedures for abnormal and accident conditions is regularly trained at a full-scale simulator.

All above given procedures (AOPs, EOPs, SAMGs, DAMs - diverse and mobile, and EDMGs) are created in the framework of one philosophy. The procedures are described in the same form and provide for defence-in-depth in the second through the fourth level following the International Nuclear Safety Advisory Group INSAG 10 document issued by the IAEA. All emergency procedures and other related documents of Accident Management type were prepared in accordance with the methodology and in cooperation with the Westinghouse Company.

19.5 Engineering and technical support

The SÚJB has its engineering support ensured through:

a) its own technical support organisation (TSO),
b) long-term cooperation with external independent experts,
c) short-term or ad hoc cooperation with specialized companies, scientific or research institutes or universities.

The technical support organization is part of the National Radiation Protection Institute. This organization continues to expand, however, at this time, it provides the SÚJB with support in the areas of calculations, support to inspector activities where its employees are often nominated as invited persons for the inspection and participates in the review activities of the SÚJB. Examples include reports of organizational changes of the licence holder, assessment of design modifications, assessment of the feedback system, etc.

The SÚJB also maintains long-term cooperation with independent experts (external assessors), especially in the field of investigation of operational events (feedback). These experts, who work in other sectors of technology, but in the same field (feedback), bring a lot of important information and perspective “from the outside”.

The SÚJB further announces contracts for independent assessment of documentation, materials testing, assessment of the results of controls of the licence holder and many other areas.

The organizational structure of the corporate Central Engineering Section of ČEZ, a. s., incorporates the following departments:

- NPP Engineering,
- Project Preparation and Implementation,
- Technical Support,
- Support and Planning,
- Design Authority.

The above units execute and coordinate the activities of engineering and technical support, including the role of the NPP Design Authority and NPP reliability and long-term operation management support. These central units have a common competence for both Czech nuclear power plants. The responsibilities and rights of the Central Engineering Section are determined in the control documents of ČEZ, a. s.

The key areas under the responsibility of the Central Engineering Section include particularly:

- design administration including the role of the NPP Design Authority,
- equipment configuration change process management and execution.

The main tasks of the Central Engineering Section in the field of design administration for Dukovany NPP and Temelín NPP are:

- NPP configuration management with the application of the principles of Configuration Management.
- Consolidation of information about designs and their design basis and assumptions including their maintenance.
- Provision of the role of Design Authority including independent assessment of equipment configuration changes.
- Creation and update of the List of specific equipment and specific equipment specially designed.

- Equipment classification process control.
- Preparation of long-term operation beyond the design lifetime.
- Ageing and lifetime management as an integral part of the SSC reliability management process.

The execution of the role of "Design Authority" is an independent area carried out over most processes of ČEZ, a. s., Nuclear Energy Division for both NPPs. This role including technical and engineering support is provided by highly educated personnel, qualified for specific tasks they perform themselves, or which are performed under their supervision.

Close working relationships exist between the Design Authority department and the operational units of both NPPs, including Maintenance of Assets units as well as certain units of the Safety and Asset Management sections, which are formally defined in ČEZ, a. s., managing documents. When performing the technical and engineering support ČEZ, a. s., closely cooperates with the general designer of Czech nuclear power plants, ÚJV Řež, a. s., Energoprojekt Praha Division, as well as with the Russian design organizations, which are authors of the original type designs of the VVER nuclear units. Further cooperation is continuously in progress with qualified research and scientific organizations and universities, as well as with designers of the suppliers for individual SSCs.

In the field of technical development, a close working relationship exists between the NPP Design Authority and Engineering departments.

The main tasks of the Central Engineering Section in the field of equipment configuration changes management are as follows:

In the phase of pre-designing stage:

- Acceptance and assessment of requirements (technical initiations) of the equipment administrators department, operational department and other departments of both NPPs for the equipment configuration changes.
- Analyses and preparation of the technical solution of the specified technical problems.
- The preparation of conceptual design assignment for respective required and relevant changes in the equipment configuration (business plan, project plan), preparation of logical complexes development plan regarding to organizational unit development strategy.
- Complex assessment of technical, operational and safety aspects of prepared change in the equipment configuration, including fulfilment of legislative requirements to the state authorities.
- Equipment qualification process control.

In the phase of design preparation and implementation:

- Check of design documentation of the equipment configuration changes from the viewpoint of observance of a conceptual technical assignment, which placed this change into the designing stage.
- Technical support during implementation (installation) of the equipment configuration changes and during verification and testing of modified design functions affected by these changes.
- Preparation of the technical part of the assessment of the changes made in equipment configuration (final modification assessment).

The execution of technical and engineering support of both NPPs associated with the preparation and implementation of changes in equipment configuration is managed by advisory boards of Managing Directors of Dukovany and Temelín NPPs – Technical Committee of NPPs.

Preparing and Realization of Projects Department, which ensures technical and commercial preparation of the designs as well as the implementation of the equipment or system modifications, so that the equipment administration units, or the operational units are entrusted with the charge of modified and tested equipment including delivery of required documentation. The NPP Engineering and Preparing and Realization of Projects departments cooperate even in evaluating the technical and economic benefit of each modification of the equipment and system.

The renovation and upgrading of safety, control and information systems at Dukovany NPP is assured within the organization structure of the Preparing and Realization of Projects Department by the project team Renovation of Instrumentation and Control Systems at Dukovany NPP that controls this extensive project. The team assures and controls all technical and investment activities related to this project and in the technical area, it closely co-operates with the Design Changes Engineering Department.

A separate section in the corporate organizational structure of ČEZ, a. s., is NPP Quality Control, which includes the following departments:

- Special Processes at NPPs,
- Quality Control of NPPs,
- Technical Quality of NPPs,
- Qualification and Evaluation of NPP Suppliers,
- Monitoring and Measuring at NPPs.

The group's interest in the area of quality control at NPPs is to ensure a high level of quality and safety of Temelín NPP and Dukovany NPP to ensure safe, reliable and efficient production of electricity in the Nuclear Energy Division of ČEZ, a. s.

The fulfilment of the main strategic directions and goals of the Nuclear Energy Division in the field of management is based on the following components:

- Quality, i.e., safe, reliable and economically efficient operation of NPPs in the Czech Republic.
- Effective organization and management system supporting the achievement of quality, safety and production goals.
- The role of guarantor of special processes and technical quality in the Nuclear Energy Division (QA).
- Qualification and evaluation of suppliers in order to ensure the highest quality of materials and services supplied to the Nuclear Energy Division (QC).
- Supervision to ensure the highest quality of materials and services supplied to the Nuclear Energy Division (QC).
- Performance of non-destructive testing, special testing and metrology in the Nuclear Energy Division (QI) in the required quality.

Special Processes at NPPs

The aim of performing activities in this area is to ensure the performance of the guarantor of special processes in accordance with the QA principles. These include quality control and assurance, in particular in the area of welding, soldering, non-destructive testing, heat treatment, forming, surface finishing, destructive testing, personnel training in special processes (non-destructive testing, welding) in the design, manufacture, installation and repairs of piping systems and equipment (SSC) at nuclear power plants in the Nuclear Energy Division with a unified approach at both NPPs.

This process includes the setting of quality requirements (defining requirements for special processes, i.e., processing the uniform requirements for qualification, certification, performance, etc., including managing and working documentation for special processes) and periodic review (independent inspection) to verify compliance with the rules and their effective setting. Using the outputs of the regular review and suggestions for improvement, the set rules are continuously optimised to prevent the occurrence of nonconformities and events to ensure the safe and reliable operation of both NPPs.

At the same time, training and qualification of lower-level welding personnel and personnel for the performance of non-destructive testing are ensured within this unit, in particular their provision through their training and implementation centre. Expert assessment is also provided through this centre, i.e., performing laboratory tests in order to verify the material properties.

Technical Quality of NPPs

The aim of performing activities in this area is to ensure the performance of the guarantor of technical quality in accordance with the QA principles. This involves quality control and assurance in the areas of mechanical, construction, electrical, measurement and regulation and diagnostics with a unified approach at both NPPs. This process includes the setting of quality requirements (rules for performing inspections, including qualifications requirements and output of these inspections and further development of inspection methods) and regular review (performing independent inspections) to verify compliance with the set rules and their effective setting. Using the outputs of the regular review and suggestions for improvement, the set rules are continuously optimised to prevent the occurrence of nonconformities and events to ensure the safe and reliable operation of both NPPs.

Qualification and Evaluation of NPP Suppliers

The aim of performing activities in this area is to contribute to ensuring the highest quality level of materials and services supplied to the Nuclear Energy Division in accordance with the QC principles. For safety-relevant items, execution of the outsourced process is subject to the supervision by a licensee. The licence holder's supervision of outsourced processes or their parts (activities) is documented in the sense of meeting the legal requirements for the supply chain management system in the form of supplier audits and evaluation of the performance of supplier activities (see Chapter 13.5).

Quality Control of NPPs

This central unit has the common competence for both Czech nuclear power plants of the licence holder. In accordance with the principles of QC, it is responsible for supervision in the area of quality control over the supplies of materials and services (in the form of customer and incoming inspections) to the extent of its competence and in the framework of relevant internal legislation (in particular ensuring special processes and technical quality). Another activity of the unit is to ensure updates, changes and supervision of the in-service inspection program.

Monitoring and Measuring at NPPs

This central unit has the common competence for both Czech nuclear power plants of the licence holder. In accordance with the QI principles, it ensures the role of performance of non-destructive testing (pre-operational, initial in-service, in-service and extraordinary NDT on SSCs of the Nuclear Energy Division), special inspections and metrology (ensuring the performance of initial, periodic and control calibrations, metrological control and inter-laboratory comparisons), to the extent of its competence and in the framework of relevant internal legislation. Another activity of the unit is the administration and maintenance of calibration gauges and test specimens.

Regulatory review and inspection activities

The internal regulations of the SÚJB set out an obligation to control and review through (especially routine inspections by site inspectors) engineering support of the licence holder. This happens on a relatively large scale.

In legislation, modifications at the nuclear installation are divided into:

a) modifications authorized by the SÚJB,
b) modifications notified to the SÚJB in advance,

c) modifications notified to the SÚJB in bulk retroactively.

For authorized modifications (modifications affecting nuclear safety), the SÚJB specialists assess in detail the notified modification, its causes, and consequences, and in particular its relation to the nuclear installation design, and that this modification will not lead to the reduction in the level of nuclear safety. The administrative period allows the SÚJB to seek the opinion of independent assessors.

Modifications related to nuclear safety are the modifications notified in advance with a time limit of 30 days before the modification implementation; this period is used by the SÚJB to assess the notified modification and also to check whether it is an authorized modification. An exception in terms of the obligation to notify 30 days in advance includes such modifications, where inactivity of the licence holder would lead to a reduction in the level of nuclear safety, i.e., risk of delay. For these modifications, the licence holder shall notify them before the modification implementation, but the extent of evidence required by legislation remains unchanged. The licence holder usually tries, beyond the obligations set out in legislation, to notify the Office through presentations and discussions about upcoming and planned modifications, describe better and justify these modifications.

19.6 Reporting of incidents significant to nuclear safety

One of the basic legal obligations of the nuclear installation operator is to immediately notify safety related events to the Regulatory Body. Transferred reports cover the solution of events and non-nominal states, concerning nuclear safety, radiation and physical protection, emergency preparedness, and nuclear materials management, as well as all other activities and changes affecting nuclear safety and radiation protection.

The extent and method for transfer of information on selected events in respect of nuclear power plant's operational safety are established in Decree No. 21/2017 Coll., on ensuring nuclear safety of a nuclear installation and in Safety Guide BN-JB-5.2, Making Use of Operating Experience at Nuclear Installations. The reporting procedures are described in the plant's internal documents. The Regulatory Body is regularly informed on the operational state of all reactor units through a daily report, which is always mutually consulted and amended by verbal commentary on other current information from the morning operative session of the shift engineer. Furthermore, SÚJB inspectors have online access to shift operational logbook and other applications such as application for recording nonconformities and events at the NPP. The inspectors are acquainted with other scheduled activities for the nearest period through a valid daily operation plan.

For the operative communication (provable immediate transfer of information) both NPPs established a special log of operative contact between the operator and the SÚJB site inspectors.

Statistics of the events significant to safety reported over the past three years

Statistics of events at nuclear installations in the reference year are presented in annual reports prepared by the SÚJB[16]. Basic information on the most significant events that occurred at the Dukovany NPP and the Temelín NPP in the past three years is presented in Chapter 6.5.

Documentation and publication of reported events by the licence holder and the regulatory body

The SÚJB registers all the operational events reported in its database. Both significant and less significant operational events are registered. This database is primarily used by the Feedback Unit of the SÚJB during controls of the investigation of events of the licence holder; the database is also used for transmitting information between system inspectors of the SÚJB and other specialists. Inspectors

[16] http://www.sujb.cz/dokumenty-a-publikace/vyrocni-zpravy/vyrocni-zpravy-sujb/

record their findings and evaluation in the database that are related to this event. Such information is further used by the Feedback Unit in the generation of questions to the licence holder and in subsequent assessment of the investigation of events by the licence holder.

The licence holder, ČEZ, a. s., documents all the events in its databases. It notifies the SÚJB of all nonconformities and events, their consequences, events important to nuclear safety and radiation protection and submits their analyses to the SÚJB regularly, with proposals for corrective measures and information on the state of implementation of these measures. In addition, ČEZ, a. s., notifies the Presidents of the Regions, the Civil Security Committee, Regional Operation Information Centre of the Fire Rescue Service, Operation Information Centre of the General Directorate of Fire Rescue Service of a radiation incident and a radiation accident (see Chapter 16).

Strategies for using the INES scale

The licence holder, ČEZ, a. s., performs an internal classification of events according to the INES scale. Subsequently, according to Safety Guide BN-JB 5.2, analysis is submitted to the SÚJB, which is the national coordinator and has the right to finally reconsider the classification made by the licence holder.

Regulatory review and inspection activities

Under its inspection activities, the SÚJB checks whether the licence holder registers the events, which are subject to notification obligations, in its databases and whether they are properly categorized in terms of their significance.

Other activities take place under the feedback investigation (see Chapter 19.7).

19.7 Operational experience feedback

The requirements for holders of a licence in the area of utilization of operating experience and operational event feedback are contained in Decree No. 21/2017 Coll., on ensuring nuclear safety of a nuclear installation.

Section 4 of the Decree states what information should be used by the feedback system of the licence holder:

- information from operational events,
- experience from other nuclear installations including foreign installations, and
- experience from other technical and technological fields.

Section 5 of the Decree states the requirements for the investigation of an operational event:

1. An operational event shall be investigated in order to identify the following
    a) causes and circumstances of an operational event,
    b) development of the deterioration in nuclear safety during operation of a nuclear installation, and
    c) extent of reduction of safety margins and influence of the level of defence in depth.
2. In the context of the investigation of an operational event, a licensee shall
    a) evaluate the relevance of an operational event to nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiological emergency management, security of a nuclear installation, and its consequences,
    b) determine the course of an operational event, including establishment of any deviation or failure,

d) evaluate the activities of the staff, using the methods for the impact assessment of human and organisational factors,
e) evaluate the impact of the safety culture on an operational event,
f) analyse direct causes and root causes of an operational event,
g) identify any negative trend relevant to nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiological emergency management and security, and
h) identify any reduction of the level of safety margins and increase of the risk of a related operational event.

3. The investigation of an operational event shall be carried out immediately. The investigation of a significant operational event should be given priority.

Section 6 of Decree No. 21/2017 Coll., defines the criteria for categorisation of operational events among significant or less significant operational events.

Overview of programs of licence holders for the feedback of information on operating experience from domestic nuclear installations and from nuclear installations abroad; procedures to analyse domestic events; procedures to draw conclusions and to implement any necessary modification to the installation and to personnel training programs and simulators

The ČEZ, a. s., nuclear power plants apply the system permitting to benefit from their own operating experience – Dukovany NPP since the beginning of its commercial operation in 1985, and Temelín NPP during its constructions and commissioning. At the same time also experience from international nuclear power plants, obtained from the Incident Reporting System (IRS) and WANO networks, JRC Clearinghouse, and from operators in the Slovak Republic and experience from the second power plant in the Czech Republic and relevant non-nuclear industry, is used in the NPP. The whole process, which includes an examination of the operational event and non-conformity causes, adoption of remedial measures and feedback of experience from these events and nonconformities, is ensured by units in the relevant NPP, which report directly to the NPP Director.

In 2018, a new department was established in the central department of ČEZ, a. s., that performs the supervisory activities for the investigation of events. The processes of recording, investigation of events and the use of experience are described in the managing documentation that is common to both NPPs.

The process covers methods for gathering information on operational events and nonconformities including Near Miss, their registration, investigation procedure, and analysis of their causes, categorisation of relevance, establishment and adoption of remedial measures for these events, monitoring of their implementation and evaluation of operational events feedback effectiveness and trends. The process also includes obligation and procedure for the transfer of own experience to other NPP operators and for the dissemination of foreign and own operating experience within the power plant. For events, the investigation includes evaluation of the attributes of safety culture, which subsequently enter into the assessment of safety culture at the NPP.

The events are evaluated according to the INES international scale for evaluation of event significance in the nuclear installations. A head of the Operational Event group of the relevant NPP is responsible for the complete event-related investigation. Such a group coordinates the whole process of events investigation in the power plant, but also other further plant specialists from special units and contractors are involved in the process.

Part of the above activities is supporting personnel honesty and effort to consistently investigate all events, which may jeopardize safe and reliable operation. The principle is that an open communication setting and the admission of own mistakes is an acceptable impetus to the improvement of the safety culture, whilst the priority is not to find the guilty parties, but to improve the condition ("blame-free atmosphere").

The own procedure for analysing the causes of operational events is chosen from the set of techniques most commonly used for this purpose, e.g., the Human Performance Evaluation system (WANO methodology) or Assessment of Safety Significant Events (IAEA methodology).

For regular evaluation of the effectiveness of experience from own operational events, the main criterion is the event non-recurrence for the same causes. Repeated events or problems are regularly evaluated in the ČEZ, a. s., NPPs in annual reports on the operational events and possible further measures are proposed. Effectiveness and efficiency evaluation of corrective measures is carried out for all safety relevant events. For tracking problematic areas – trends, precursors – the coding of event causes is used. This is elaborated as a part of the annual report “Feedback from internal events”.

All employees including contractors are obliged to identify and record all events and nonconformities including Near Miss. Such records are classified by a multifunctional team into five categories, including the designation of the department responsible for settlement.

- Category 1 – Significant event, non-conformity with a high uncertainty as to the correctness of settlement and a high risk of impacts severity and recurrence probability. It is necessary to analyse the causes until the “Root Causes” of the non-conformity/event have been identified and for the investigation of which, analysis, definition of remedial measures and assignment of responsibilities for the implementation of the remedy imposed, a special, multi-disciplinary team is established, usually composed of managers of special units and led by the director of quality department. These events/nonconformities are discussed by the Correction and Prevention Commission of the relevant NPP and the causes together with the adopted corrective measures are regularly checked out by the SÚJB.
- Category 2 – Significant event, non-conformity with a high uncertainty as to the correctness of settlement and medium risk of impacts severity and recurrence probability, or with a medium uncertainty as to the correctness of settlement and high risk of impacts severity and recurrence probability. It is necessary to analyse the causes of the non-conformity/event and the investigation of which, analysis, settlement as well as the implementation of the remedy imposed require the cooperation of several units. These events/nonconformities are discussed by the Correction and Prevention Commission of the relevant NPP and the causes together with the adopted corrective measures are regularly checked out by the SÚJB.
- Category 3 – Less significant event/non-conformity with an uncertainty as to the correctness of settlement and a medium risk of impacts severity and recurrence probability, which are not under Category 1 or 2. There is a need to analyse the apparent causes of the non-conformity/event and identify and implement corrective measures. For this category, it is assumed that the competence and capacity of the unit to which it was assigned are sufficient for the analysis, definition of the remedial measures and implementation of the associated activities. These events/nonconformities are investigated within the work order of the corresponding units; these events are not discussed by the Correction and Prevention Commission but the results of the investigation are communicated to the Commission; corrective measures are checked by the Correction and Prevention Commission of the relevant NPP.
- Category 4 – Low-level events, nonconformities with high uncertainty as to the correctness of settlement and no risk, medium uncertainty and low risk, low uncertainty and medium risk of impacts severity and recurrence probability. Their possible influence on any process in the plant is being evaluated. Trend monitoring according to common causes is carried out and negative precursors are evaluated. Regular evaluation is submitted to the power plant management.

The last category is intended for the monitoring of proposals for improvement and the introduction of best practices.

- Category 5 – proposal for improvement – a condition that does not eliminate unwanted deviation from the mandatory requirement, but a way has been proposed to improve or refine this condition or achieve greater effectiveness/efficiency.

Recorded nonconformities are settled in a single system in an expert commission. The commission meets once a week. This commission, which is set up as an advisory board for NPP Director, evaluates trends and precursors of the nonconformities for which corrective measures are proposed and adopted, at its quarterly meetings. In case of recurrence and, where relevant, on request of the management, the system is set for the escalations of events/nonconformities to higher category.

The Events Investigation Commission (Correction and Prevention Commission) is established as the advisory team of the executive director of NPP for the identification of causes, corrective measures, and conclusions for investigation of the events in individual power plants, confirms at its regular meetings the completeness of the investigations of the safety-related event causes and adopts corrective measures for the elimination of their causes for the purpose of prevention of their repeating.

Significant events that can be used by other operators are transferred into the WANO network.

The events of nuclear power plants are shared within ČEZ, a. s., through the Failure Committee, Conventional Energy Division, which receives information about the events in the inactive part of the nuclear power plant and at the same time, takes over information about the events at conventional power plants applicable to nuclear power plants. Lessons learned from the events are thus shared across the company.

The power plant personnel are informed on selected events both from internal and external feedback.

All commissions are an element of the safety assessment of persons responsible for safety, and their activity and results are subject to independent supervision and evaluation by special units that are not responsible for operating results.

The SÚJB regularly supervises this process, and in some cases of important events, inspects the progress of examination and assessment of the sufficiency of remedial measures taken during event management.

Basic information on the most significant events that occurred at the Dukovany NPP and at the Temelín NPP in the past three years is presented in Chapter 6.5.

Both NPPs are actively involved in the system that enables sharing of event information (WER) within the framework of WANO. This allows active and effective cooperation with other NPP operators in operating experience exchange. Within the system of the use external experience, other sources are also used, e.g., IRS (IAEA) and JRC Clearinghouse. Analysis and utilization of operating experience and technical information from other operated nuclear power plants conduce to improvement of the NPP operation safety and reliability. When sharing their operating experience within the framework of WANO, ČEZ, a. s., NPPs conduce to the effective application of this process within the international context.

The above given system of taking profit from the events in other nuclear installations on worldwide basis (WANO) is incorporated into the event investigation process. The main objective is to transfer and to utilize any operating experience and technical information acquired by nuclear power plant operators in the ČEZ, a. s., NPPs practice.

The system is described in a special instruction and comprises five basic programs:

1. Preparation of the reports on external operational events (WANO-WER, IAEA-IRS, JRC).
2. Provision of information about events occurred at NPPs of ČEZ, a. s., to the WANO network.

3. Drawing up WANO SOER (Significant Operating Experience Report) and TOER (JRC) reports and recommendations.
4. Direct information exchange between the operators (e.g., Temelín NPP/Dukovany NPP ↔ Bohunice NPP, Mochovce NPP, Paks NPP).
5. Good practice, JIT information.

All the information obtained is assessed in terms of its relevance to the NPP. Selected information from WANO, IAEA as well as INPO and OECD-NEA sources is included into the agenda of the Correction and Prevention Commissions at both sites, laying down the requirement to assess external events by special units of the NPP. Subsequently, remedial measures are defined based on this assessment by the Correction and Prevention Commission to prevent similar events at the NPP. All obtained information is archived in form of a database and used by the technical department experts as technical support in solving problems, equipment modification and personnel training.

The SÚJB carries out regular inspections in the field of the use of operating experience. These include

a) internal feedback inspections,
b) external feedback inspections.

Internal feedback inspections take place according to the internal regulations of the SÚJB quarterly on each site. The inspection reviews the investigation of operational events by the licence holder and includes usually all significant operational events. At the discretion of the inspection team, the inspection may include the review of the investigation of less significant operational events. The inspection covers the own investigation of the event by the licence holder, identification of direct and root causes, impact assessment of human factor on the operational event, impact assessment of safety culture and the definition of adequate remedial measures.

For external feedback inspections, which take place once a year following the internal regulations of the SÚJB, the inspection team chooses especially the events published in the IRS system, evaluates these events for relevance to the nuclear installations operated in the Czech Republic, and includes these subsequently in the inspection.

The inspection reviews the way in which the licence holder manages external events. Whether and why they were determined to be relevant or irrelevant to its nuclear installation, and what lessons the licence holder learned from the analysis of events, what remedial measures were implemented in response to external events at its nuclear installation. Regulatory programs for operating experience feedback and sharing of important experience with international organizations and other regulatory bodies. The SÚJB regularly publishes the most interesting events through the IAEA/IRS system. The events are presented at the IRS/INES working groups or WGOE (Working Group on Operating Experience) of OECD-NEA. In preparation of the report on the event for the IRS, it consults the final report for the IRS with the JRC.

The SÚJB presents more information about events and operating experience through bilateral and multilateral forums (e.g., OECD-NEA) and topical conferences and bilateral agreements on the exchange of information. The SÚJB publishes information about all the events rated INES 0 and above on its website.

19.8 Management of spent nuclear fuel and radioactive waste produced from operation of a nuclear installation

Radioactive waste and spent nuclear fuel management in the Czech Republic is regulated by the Atomic Act and Decree No. 377/2016 Coll., on the requirements for the safe management of radioactive waste and on the decommissioning of nuclear installations or category III or IV workplaces. These legal documents define the rules and requirements for the safe management of radioactive waste.

Spent fuel is removed from the reactor core to the adjacent spent fuel storage pool located in the reactor hall (each reactor has its own storage pool). Spent fuel is stored in the storage pools for at least six years and then loaded into casks type approved for spent fuel transportation and storage. In the cask, spent fuel is stored in dry condition in the space filled with inert gas – Helium. Filled casks are deposited in spent fuel storage facilities at Dukovany NPP and Temelín NPP.

Radioactive waste produced from normal operation of both nuclear power plants is continuously collected, sorted, processed, and conditioned in the place of production and then stored within the Dukovany Radioactive Waste Repository. With respect to ecological and economic conditions of the NPPs, radioactive waste storage in this repository represents an optimal option for fulfilling the basic objective – its isolation from the environment, until the activity of deposited radionuclides is significantly reduced as a result of decay. Storage in the repository is conditioned by processing the radioactive waste into a form suitable for storage fulfilling the conditions for acceptability of the Dukovany Radioactive Waste Repository.

Wastewaters containing radionuclides are processed into the form of liquid radioactive concentrate (in the evaporating system). Subsequently, the concentrate is bituminised into a form suitable for deposition. The capacity of bituminisation lines allows for the continuous treatment of newly produced waste. Processed volumes of the concentrate are the minimum needed for the operation of the bituminisation lines at both NPPs.

Solid Radioactive Waste is systematically sorted and its radioactivity is measured. Based on the measurements, a part of the waste with the content of radionuclides, which meets the criteria for the release of waste originating from controlled zones of both NPPs (criteria based on the EU, ICRP and IAEA documents) is discharged to the environment in a controlled manner in compliance with the legal regulations (Decree No. 422/2016 Coll., on radiation protection and security of a radioactive source). The remaining waste is characterized, processed, treated, and subsequently deposited in the Radioactive Waste Repository. Fragmentation, decontamination, crushing, and low-pressure and high-pressure pressing and melting technologies are used for the processing of solid radioactive waste before conditioning. Solid radioactive waste is treated with the use of technologies available in facilities of external contractors outside the territory of the Czech Republic. They currently concern high-pressure pressing, incineration, and re-melting of contaminated metal materials.

Activated materials (e.g., parts of detectors of in-core measurements), which due to a high content of limited radionuclides (^{63}Ni) do not meet the acceptability conditions for depositing in Radioactive Waste Depository, are stored in NPP, with a view to depositing them in a deep geological repository.

Radioactive sediments and deteriorated sorbents are stored in the storage tanks and then fixed in geopolymer matrices (SIAL and ALUSIL) characterized by their ability to bind high content of radioactive waste in the final product (>20% of total solids). Sludge and ion exchangers are continuously conditioned in this way at the Temelín NPP.

Both NPPs operated in the Czech Republic have comprehensively solved the issues related to the management of all kinds of radioactive waste produced in normal operation. The issues of potential radioactive waste from accidents are also being addressed.

The basic requirement during radioactive waste management is the minimization of their amount. This process includes avoidance of the waste occurrence, modification of technological equipment, operating procedure modifications and optimisation of processes during the waste treatment and processing. Radioactive waste minimization is understood as a complex process with direct impacts both on environmental and economic indicators of the NPP operator.

At NPP, the following measures are continuously implemented aimed at reducing the radioactive waste production:

- development and implementation of decontamination technologies with minimum waste production,

- separation of non-active sediments from the exchanger cleaning,
- separation, activity measurement and subsequent release of deteriorated sorbents and organic liquids from the workplace,
- restriction of objects brought into the controlled area and unrelated to working activity,
- limiting entries of persons into the controlled area,
- optimisation of protective plastic sheets usage,
- replacement of service water with condensate or demineralized water.

Radioactive waste management in the Czech Republic may not be carried out without a licence issued by the SÚJB. All licence holders for radioactive waste management are regularly inspected by the SÚJB inspectors in the fulfilment of legislative requirements for radioactive waste management.

Further information is provided in the National Report under the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, Revision 7.0, SÚJB, March 2020, [11-1].

Statement on the implementation of the obligations concerning Article 19 of the Convention

The above text proves that the legislative requirements imposed on the commissioning of a nuclear installation, its operation and performance of the proper activities conform, in the Czech Republic, to the requirements of Article 19 of the Convention.

A N N E X E S

Annex 1 List of Related Legislation

Annex 2 Technical Specifications of the Dukovany NPP and the Temelín NPP

Annex 3 National Action Plan on Strengthening Nuclear Safety of Nuclear Facilities

Annex 4 Plans for Safety Enhancement

Annex 5 Safety Culture

Annex 6 Evaluation of the Safety Performance Indicators Set

Annex 7 IAEA and WANO Missions in the Dukovany NPP and the Temelín NPP

Annex 8 Research Nuclear Installations

Annex 9 Selected References

ANNEX 1 LIST OF RELATED LEGISLATION

in the field of peaceful utilisation of nuclear energy and ionising radiation and related legislation as of 30 April 2022.

Atomic Act and its Implementing Regulations

Act No. *263/2016 Coll.,* Atomic Act, as amended

- ***Government Order No. 347/2016 Coll.,*** on tariff charges for professional activities of the State Office for Nuclear Safety, as amended *by* Government Order No 273/2019 Coll.
- ***Decree No. 358/2016 Coll.,*** on requirements for assurance of quality and technical safety and assessment and verification of conformity of selected equipment.
- ***Decree No. 359/2016 Coll***., on details of ensuring radiation extraordinary event management.
- ***Decree No. 360/2016 Coll.,*** on radiation situation monitoring.
- ***Decree No. 361/2016 Coll.,*** on security of nuclear installation and nuclear material.
- ***Decree No. 362/2016 Coll.,*** on the conditions for the award of the grant from the state budget in some existing exposure situations.
- ***Decree No. 374/2016 Coll***., on the accountancy and control of nuclear materials and reporting of information on them.
- ***Decree No. 375/2016 Coll.,*** on selected items in the nuclear area.
- ***Decree No. 376/2016 Coll.,*** on dual-use items in the nuclear area.
- ***Decree No. 377/2016 Coll***., on the requirements for the safe management of radioactive waste and on the decommissioning of nuclear installations or category III or IV workplaces.
- ***Decree No. 378/2016 Coll.,*** on siting of a nuclear installation.
- ***Decree No. 379/2016 Coll.,*** concerning the approval of some products in the field of peaceful use of nuclear energy and ionising radiation and the carriage of radioactive or fissile material.
- ***Decree No. 408/2016 Coll***., on management system requirements.
- ***Decree No. 409/2016 Coll.,*** on activities especially important from nuclear safety and radiation protection viewpoint, special professional qualification and training of persons ensuring radiation protection of the registrant.
- ***Decree No. 422/2016 Coll***., on radiation protection and security of a radioactive source.
- ***Decree No. 464/2016 Coll.***, on the process for awarding the grant from the state budget for the adoption of measures to reduce the level of exposure to the presence of radon and its decay products in indoor air in the constructions for habitation and occupancy of the public and for the adoption of measures to reduce natural radionuclides concentration in drinking water intended for public use.
- ***Decree No. 21/2017 Coll.,*** on ensuring nuclear safety of a nuclear installation.
- ***Government Order No. 35/2017 Coll.***, fixing the one-off fee relating to disposal of radioactive waste and the amount of contributions from the nuclear account to municipalities and laying down the rules for providing them.
- ***Decree No. 162/2017 Coll.,*** on requirements for safety assessment according to the Atomic Act.
- ***Decree No. 329/2017 Coll.***, on the requirements for nuclear installation design.

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- ***Decree No. 266/2019 Coll..,*** on policy for radioactive waste management and spent fuel management.
- ***Decree No. 250/2020 Coll.,*** on the method of establishing a reserve for the decommissioning of a nuclear installation and category III and category IV workplace.

Multilateral International Treaties and Treaties with IAEA

Part of applicable legislation in the given area includes the following international treaties binding to the Czech Republic

- Convention on the Physical Protection of Nuclear Materials (in Vienna on October 26, 1979, Supplement July 8, 2005, declared under No. 114/1996 Coll., No. 27/2007 Coll., and under No. 64/2016 Coll.).
- Convention on Early Notification of a Nuclear Accident (in Vienna on September 26, 1986, declared under No. 116/1996 Coll.).
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (in Vienna on September 26, 1986, declared under No. 115/1996 Coll.).
- Nuclear Safety Convention (in Vienna on June 17, 1994, declared under No. 67/1998 Coll.);
- Vienna Convention on Civil Liability for Nuclear Damage (in Vienna on May 21, 1963, declared under No. 133/1994 Coll., adjusted by Communication of the Ministry of Foreign Affairs No. 125/2000 Coll.) and amended by Protocol of 1997.
- Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (in Vienna in 1988, declared under No. 133/1994 Coll.).
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (in Vienna on September 29, 1997, declared under No. 3/2012 Coll.).
- Treaty on the Non-Proliferation of Nuclear Weapons (NPT), (in Moscow, Washington, London, on March 29, 1974, declared under No. 61/1974 Coll.).
- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, February 25, 1991, Supplements February 27, 2001 and June 4, 2004, declared under No. 91/2001 Coll., No. 27/2015 Coll., and No. 70/2017 Coll.).
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus, on June 25, 1998, declared under No. 124/2004 Coll.).
- Convention on Korean Energetics Development Organization and the Protocol supplementing the Convention on Korean Energetics Development Organization (New York, March 9, 1995, declared under No. 27/2001 Coll.).
- Agreement between the Czech Republic and the International Atomic Energy Agency on Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons (in Vienna on September 18, 1996, declared under No. 68/1998 Coll.).
- Supplemental Protocol to the Agreement between the Czech Republic and the International Atomic Energy Agency on Safeguards, based on the Treaty on Non-proliferation of Nuclear Weapons (in Vienna on September 28, 1999, declared under No. 74/2003 Coll.).
- Adapted supplemental Agreement on Technical Assistance provided by the International Atomic Energy Agency to Government of the Czech and Slovak Federal Republic (in Vienna on September 20, 1990, declared under No. 509/1990 Coll.).
- International Labour Organization Convention No. 115 Concerning the Protection of Workers Against Ionising Radiation (Geneva, June 22, 1960, declared under No. 465/1990 Coll.).

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- Comprehensive Nuclear Test Ban Treaty (New York, September 10. 1996, entered into force, signed by the Czech Republic on November 12, 1996 and ratified on September 11, 1997).
- Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage – in Vienna on September 12, 1997, signed by the Czech Republic on June 18, 1998, however it has not yet been ratified). By virtue of Act No. 158/2009 Coll., the Czech Republic adapted the amount of liability of the operators and state guarantees to this protocol.
- Convention on Supplementary Compensation for Nuclear Damage – in Vienna on September 12, 1997, the Government Order No. 97/1998, signed by the Czech Republic, however has not been ratified yet).

Selected Acts Concerning the SÚJB

- **Act No. 505/1990 Coll.**, on Metrology, as amended.
- **Act No. 111/1994 Coll.,** on Road Transport, as amended.
- **Act No. 19/1997 Coll.,** on Some Measures Concerning Chemical Weapons Prohibition and on Amendments and Additions to Act No. 50/1976 Coll., on Town and Country Planning and Building Code (the Building Act), as amended, Act No. 455/1991 Coll., on Trade Licensing (the Trade Licensing Act), as amended, and Act No. 140/1961 Coll., the Criminal Code, as amended.
- **Act No. 123/1998 Coll.,** on the Right to Information on the Environment, as amended.
- **Act No. 106/1999 Coll.,** on Free Access to Information, as amended.
- **Act No. 100/2001 Coll.,** on Environmental Impact Assessment and on Amendment to Certain Related Acts (the Act on Environmental Impact Assessment), as amended.
- **Act No. 281/2002 Coll.,** on Some Measures Related to Prohibition of Bacteriological (Biological) and Toxin Weapons and on Amendments to Trades Licensing Act, as amended.
- **Act No. 500/2004 Coll.,** Code of Administrative Procedure, as amended.
- **Act No. 634/2004 Coll.,** on Administrative Fees, as amended.
- **Act No. 594/2004 Coll.,** Implementing the European Community Regime for the Control of Exports of Dual-use Items and Technology.
- **Act No. 412/2005 Coll.,** on the Protection of Classified Information and on Security Capacity, as amended.
- **Act No. 183/2006 Coll.,** on Spatial Planning and Building Rules (Building Act) as amended,
  note: Act No. 283/2021 Coll., on Town and Country Planning and Building Code (Building Act) will enter into force on July 1, 2023.
- **Act No. 372/2011 Coll.,** on Medical Services and Conditions for their Provision (Act on Health Services), as amended.
- **Act No. 373/2011 Coll.,** on Specific Medical Services.
- **Act No. 255/2012 Coll.,** on Inspection (Inspection Code), as amended by Act. No. 183/2017 Coll.

Emergency Legislation (selected legislation)

- **Constitutional Act No. 110/1998 Coll.**, on the security of the Czech Republic, as amended by Constitutional Act No. 300/2000 Coll.

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- **Decree No. 328/2001 Coll.,** on certain details of providing of integrated emergency system, as amended.
- **Act No. 239/2000 Coll.,** on Integrated Rescue System and on Amendment to Certain Related Acts, as amended, as amended.
- **Act No. 240/2000 Coll.,** on Crisis Management and on Amendment to Certain Related Acts (Crisis Act), as amended.
- **Act No. 224/2015 Coll.,** on Prevention of Major Accidents Caused by Selected Hazardous Chemicals or Chemical Mixtures and Amending Act No. 634/2004 Coll., on Administrative Fees, as amended (the Act on Prevention of Major Accidents).

ANNEX 2 TECHNICAL PARAMETERS OF THE DUKOVANY NPP AND THE TEMELÍN NPP

Reactor	Reactor type	Pressurized water reactor VVER 440/213
	Number of units in the locality	4
	Number of cooling loops per reactor	6
	Number of fuel assemblies	312
	Number of control assemblies	37
	Nominal thermal output	1444 MWt
	Nominal overpressure at reactor outlet	12.262 MPa
	Nominal temperature at reactor outlet	298.6 ± 2 °C
	Nominal coolant temperature at reactor inlet	268 ± 2 °C
	Fuel enrichment	3.82 % U235 (profiled assembly), 4.38 % U235 (Gd-1), 4.25 % U235 (Gd-2)
	Number of main coolant pumps per reactor	6
	MCP coolant flow	7100 m3/h
Steam generator	Number of steam generators per reactor	6, horizontal mounting
	SG nominal feedwater temperature	227.2 °C
	Steam production per SG	470 t.p.h.
	SG steam temperature	260 °C
Secondary circuit	Nominal stem overpressure in MSH	4.480 MPa
	Number of turbines per reactor	2
	Turbine	Three-casing, 1 high-pressure section, 2 low-pressure sections
	Nominal turbine speed	3000 r.p.m.
	Nominal electric power per turbine	251.02 MW
Power output	Generator	Combined hydrogen and water cooling
	Generator active power	255 MW
	Generator nominal voltage	15.75 kV±5%
	Nominal frequency	50 Hz ± 2%

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Condenser	Number per turbine	1, two-casing
	Nominal cooling water flow rate	35 000 m3 per hour
Ultimate heat sink	Forced-draught cooling towers	
	Layout of forced-draught towers	2 cells per essential service water subsystem, 12 cells per power plant

Technical Parameters of the Temelín NPP

Reactor	Reactor type	Pressurized water reactor VVER 1000/V320
	Number of units on site	2
	Number of cooling loops per reactor	4
	Number of fuel assemblies	163
	Number of rod cluster control assemblies	61
	Nominal thermal output	3120 MWt
	Nominal overpressure at reactor outlet	15.7 MPa
	Nominal temperature at reactor outlet	321.0 ± 5.5 °C
	Nominal coolant temperature at reactor inlet	289.7 ± 2.5 °C
	Fuel enrichment	max. 5% U 235
	Number of main coolant pumps per reactor	4
	MCP coolant flow	21 200 m^3 per hour
Steam generator	Number of steam generators per reactor	4, horizontal mounting
	SG nominal feedwater temperature	220 °C
	Steam production per SG	1470 t.p.h.
	SG steam temperature	278.5 °C
Secondary circuit	Steam pressure before the turbine inlet	5.743 MPa
	Number of turbines per reactor	1
	Turbine	Four-casing, 1 high-pressure section, 3 low-pressure sections
	Nominal turbine speed	3000 r.p.m.

Annex 2

	Nominal electric power per turbine	1080.3 MW
Power output	Generator	Three-phase, hydrogen-cooled with direct cooling of stator winding
	Generator active power	1125 MW
	Generator rated voltage	24 kV
	Nominal frequency	50 Hz
Condenser	Number per turbine	3
	Nominal cooling water flow rate	10.140 kg/s
Ultimate heat sink	Cooling tanks with spray	
	Layout of cooling tanks	Each cooling tank consists of two functional independent halves, one in operation and one as backup

ANNEX 3 NATIONAL ACTION PLAN ON STRENGTHENING NUCLEAR SAFETY OF NUCLEAR FACILITIES

Revision 5 of the National Action Plan was completed in February 2022 and its Czech version can be found here:

https://www.sujb.cz/fileadmin/sujb/docs/jaderna-bezpecnost/Cesky_NAcP_Rev5_final__002_.pdf
and

Revision 5 in the English language can be found here:

https://www.sujb.cz/fileadmin/sujb/docs/jaderna-bezpecnost/Czech_National_Action_Plan_rev5.pdf

From the history of preparation and development:

On 31 December 2012, the SÚJB forwarded the "Post-Fukushima National Action Plan on Strengthening Nuclear Safety of Nuclear Facilities in the Czech Republic" to the European Commission.

The Action Plan was prepared following the conclusions of the Stress Tests, as published along with the Joint Declaration of the European Nuclear Safety Regulators Group (ENSREG) and the European Commission on 26 April 2012.

The action plan contains a set of all main conclusions and recommendations included in the National Report of Stress Tests for the Czech Republic[17], reports of ENSREG examinations, including the Final Summary Report of the 2nd Extraordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety.

In accordance with the structure proposed by the ENSREG, the Action Plan of the Czech Republic is divided into four parts:

- Part I deals with the problems related to external risks (earthquakes, floods, extreme climatic conditions), loss of ultimate heat sink and full power failure or their combination.
- Part II deals with the national infrastructure, emergency preparedness and response to extraordinary events and the international cooperation.
- Part III relates to cross-functional issues.
- Part IV includes a list of measures aimed at implementing all recommendations contained in Parts I to III. This is a summary of corrective actions identified during periodic safety review of Dukovany NPP and Temelín NPP after twenty or ten years of operation, safety-related findings during IAEA missions, findings ascertained during the implementation of Dukovany NPP LTO project and, last but not least, conclusions of Stress Tests performed in the light of accident occurred at the Fukushima Daiichi NPP.

[17] https://www.sujb.cz/fileadmin/sujb/docs/aktualne/Country_Report_CZ_Final.pdf

Příloha 3

The proposed measures will be implemented by the operator of both nuclear power plants, the company ČEZ, a. s.

General steps, e.g. adjustments in nuclear legislation or issues concerning international cooperation, will be implemented by the competent state administrative bodies, in particular the SÚJB and other competent ministries.

The Action Plan of the Czech Republic is a live document, which is revised and continuously updated taking into account the latest state of knowledge.

Therefore, an update of the Action Plan of the Czech Republic has been prepared in July 2013, which reflects the results of the Peer Review of the Action Plans organized by the ENSREG in April 2013 as well as the outcomes of the negotiations between ČEZ, a. s., and the SÚJB; Revision 2 of the Action Plan of the Czech Republic has been prepared in January 2015, Revision 3 in January 2018, Revision 4 in December 2019 and the most recent Revision 5, as mentioned above, has been prepared in January 2022.

Status of compliance

All measures contained in the National Action Plan were completed by the end of 2018. The only exception is Measure No. 50 aimed at implementing measures to maintain the long-term integrity of containment at the Temelín NPP, which will be completed by the end of 2024.

ČEZ, a. s., decided to add another independent system that will end the course of a severe accident in its early stage and ensure the integrity of reactor pressure vessel. This involves the provision of alternative long-term heat removal from the containment using the added mobile pumping station powered by a diesel engine and a filtered containment venting system.

During the preparatory phase, the date of implementation of this measure was changed from 2022 to 2024 in the schedule of the National Action Plan of the Czech Republic, taking into account the complexity of implementing the new technical solution and the need to assess its effectiveness, as well as the legal framework for preparing this large project.

ANNEX 4 PLANS FOR SAFETY ENHANCEMENT

In order to continuously enhance the level of nuclear safety, radiation protection, technical safety, radiation situation monitoring, radiation extraordinary event management, and security, as provided for by the Atomic Act and its Decree No. 408/2016 Coll., a holder of a licence, ČEZ, a. s., shall develop and annually update Plans for Safety Enhancement of the Dukovany NPP/Temelín NPP.

The Plans for Safety Enhancement are based on the following:

- outcomes of the Periodic Safety Review (comparing the current state to legislation and the latest standards and recommendations in the world);
- outputs of the Risk Management system (continued assessment of the state of a power plant both in terms of compliance with legislation and in terms of comparison with the world's best practice);
- inputs from the Settlement of the Proposals for Improvement system;
- Medium-term Plan of the Dukovany NPP/Temelín NPP and Annual Plan of the Dukovany NPP/Temelín NPP;
- ad-hoc commitments made by ČEZ, a. s., in relation to the SÚJB.

The Plans for Safety Enhancement are structured into three chapters:

- evaluation of the measures due in the previous year;
- draft measures with planned completion in the current year - measures fulfilling the objectives of enhancing safety are based on the Policy of Safety in Nuclear Activities;
- perspective (long-term projects whose implementation is planned in the longer term).

The guarantor and the date of fulfilment are set for each proposed measure including clear criterion for fulfilment. The origin of requirement and the specific objective set out in the Policy of Safety in Nuclear Activities, which is supported by the measure, are recorded for each measure.

The Plans for Safety Enhancement are discussed and approved at the Committees for Safety of EDU/ETE; the Director of Nuclear Energy Division is informed about the extent and approval of the Plans for Safety Enhancement. The approved Plans for Safety Enhancement are presented to the SÚJB as a commitment to continuously enhance the level of safety.

In the years 2016 - 2018, for example, the following projects were implemented under the Plans for Safety Enhancement:

- forced-draught towers in the Dukovany NPP - independent ultimate heat sink;
- optimisation of the non-conformity management system;
- implementation of important measurements in PAMS (compliance with RG 1.97);
- an earlier decision on protective measure for the evacuation of the population;
- definition of the boundaries of the vital areas;
- introduction of the management of contractors' qualification;
- introduction of the risk management system;

- activation of the program of succession and knowledge management in the context of generation exchange of personnel;
- self-assessment of Severe Accident Management, comparison with the global standards;
- optimisation of the emergency response organization and arrangement of the emergency centre;
- revision of the program of operational inspections over the state of essential service water system;
- launching of the project for areas at risk with weld joints;
- introduction of the program to enhance the reliability of the human factor;
- updating of the PSA model;
- redesign of processes and organization - establishment of the Nuclear Energy Division;
- modernization of the electronic fire alarm system in the Dukovany NPP;
- introduction of the Ageing Management Programme for Cables Important to Safety - Dukovany NPP;
- introduction of the Ageing Management Programme for Buried Pipes;
- backup and alternative dose rate measuring by radio transmission on site and around power plants;
- measures to protect the elements of critical information infrastructure (cyber security);
- alternative emergency control centres - improvement of the emergency preparedness system;
- SAMG upgrade;
- definition of the concept of accident management including beyond design-basis accidents and severe accidents;
- launching of the "Nuclear Professional" project for further improvement of the human performance of personnel.

In the years 2019 - 2021, for example, the following projects were implemented under the Plans for Safety Enhancement:

- update of severe accidents management guidelines according to the established concept of accident management, including beyond design basis accident and severe accidents
- the emergency commission staff was reinforced based on the experience gained during the drills and thus the management of extraordinary events was improved,
- implementation of vital areas according to the current atomic law for the security of nuclear facility,
- the methodology for evaluating extreme hazards according to the best world practice was developed and it is used,
- the record keeping and workflow of external events feedback were transferred to the passport system with the possibility of better checking of the processing and settlement of these events,
- completion of the Leadership Academy for management levels D-1 (directors), D-2 (managers) and D-3 (heads) within the framework of the long-term project "Nuclear Professionals" for further improvement of the human performance of staff,
- initiation and implementation of training of own employees and supplier employees in area of special processes,
- improvement of the fire safety of the Dukovany NPP's diesel generators by stable fire extinguishing equipment installation,

- replenishment of selected measurements to the Post Accident Monitoring System 2 and the Post Accident Monitoring System 3 of Dukovany NPP and thus the improving of monitoring of the Dukovany NPP's radiation situation,
- completion of the installation of the 3rd spent fuel storage pool cooling pump on all Dukovany NPP units,
- further strengthening of the Dukovany NPP's emergency organization by implementation technologist 3 and technologist 4 functions,
- reinforcing and qualification of the Temelin NPP's pressurizer safety valve node, including adding control of the node's armatures from main control room and emergency control room,
- ensuring the lifetime of the Temelin NPP's reactor pressure vessel by fulfilling the individual points of the reactor pressure vessel action plan,
- updating of the Temelin NPP's PSA model for more accurate determination of risk in many activities within the NPP operation,
- implementation of a new type of fuel assembly TVSA-T modification 2 on the Temelin NPP to achieve tightness and lower deflection of the assembly.

ANNEX 5 SAFETY CULTURE

In accordance with Act No. 263/2016 Coll., Decree No. 408/2016 Coll., the licence holder introduce in the management system the safety culture. Categories, characteristics and attributes for assessing the level of safety culture are defined according to WANO (Traits of a Healthy Nuclear Safety Culture — PRINCIPLES PL 2013-1).

The basic expectations for the attitudes and behaviour of individuals, leaders and organization are derived from the ten characteristics and enforced within the company:

Individual Commitment to Safety:

- All individuals take personal responsibility for safety.
- Individuals avoid complacency and continuously challenge existing conditions, assumptions, anomalies and activities to identify discrepancies that might result in errors or inappropriate actions.
- Communications maintain a focus on nuclear safety.

Management Commitment to Safety:

- Leaders demonstrate a commitment to nuclear safety in their decisions and behaviours.
- Decisions that support or affect nuclear safety are systematic, rigorous and thorough.
- Trust and respect permeate the organisation, creating a respectful work environment.

Management Systems (through guarantor of management areas, processes, leaders):

- Opportunities to continuously learn are valued, sought out and implemented.
- Issues potentially impacting safety are promptly identified, fully evaluated and promptly addressed and corrected, commensurate with their significance.
- A safety-conscious work environment (SCWE) is maintained where personnel feel free to raise nuclear safety concerns without fear of retaliation, intimidation, harassment or discrimination.
- The process of planning and controlling work activities is implemented so that nuclear safety is maintained.

The licence holder has set rules for monitoring, assessment and developing a safety culture.

Monitoring (one-time and continuous) of safety culture is the collection of data for subsequent assessment of safety culture. To ensure a comprehensive picture of safety culture, the managers collect safety culture data from several sources - e.g. observations, analyses of events and discrepancies, interviews with subordinates, questionnaires, independent evaluations from external entities, etc. Once a year, on the basis of the obtained data, the managers asses the safety culture of their department and, according to the conclusions of the assessment, propose a futher plan of development for safety culture in their department. The safety culture assessment and development plan are forwarded to a superior. Gradually, safety culture assessment and development plans are consolidated at the level of the Director of the Nuclear Energy Division.

At the same time, the safety culture assessment results are summarized and independently verified and the result of this assessment is shown by means of a radial decagon graph where each sector represents one characteristic of safety culture.

The individual layers in sectors of the radial graph show the outputs of specific assessment methods (in order from the centre of the graph):

- Questionnaire survey among employees of contractors.
- Questionnaire survey among employees of ČEZ, a. s.
- Assessment of major events.

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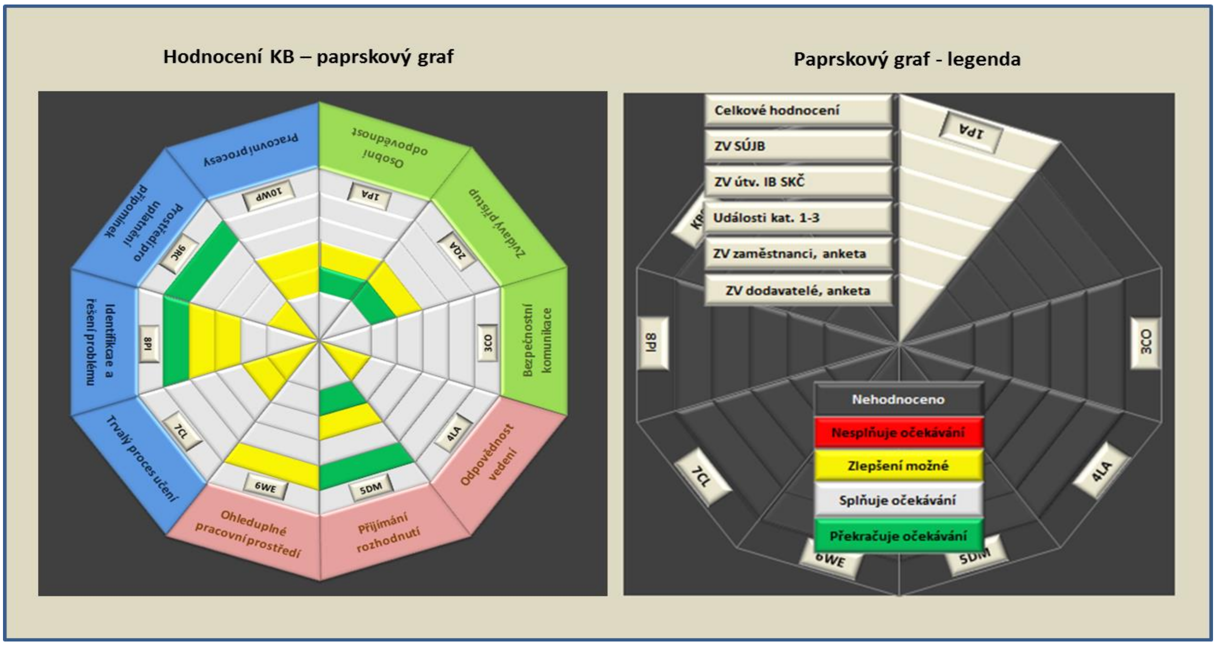
- Internal assessment of independent nuclear oversight of ČEZ, a. s.
- External independent assessment of the SÚJB.
- Cumulative assessment for each characteristic of safety culture.

Colour highlighting of individual segments (point of intersection of a sector and a layer) characterizes the result of assessment using a particular method for that characteristic.

Figure 1: Radial graph - assessment of the safety culture of Nuclear Energy Division in 2018



The overall assessment of safety culture for each characteristic of safety culture is the arithmetic mean of all the assessment methods used and is shown in the sixth (last) layer of the radial graph with the code identification of the characteristic.

The development (improvement) of the safety culture within the company ČEZ, a. s., requires a systematic, long-term work, consistency and perseverance. Leaders play a very important role in the development of safety culture. The monitoring of changes and trends in the attitudes of employees and contractors is carried out using a questionnaire survey index and based on group and individual interviews. The basis for developing a safety culture within the company ČEZ, a. s., are the Plans for Safety Culture Development that determine systemic measures in response to the outcomes of the assessment of safety culture for the previous period.

To ensure the clarity of characteristic attributes of a healthy safetyculture, various forms of training in the areas of safety culture are organisedfor employees and contractors. At the meetings, the "Safety Notes" are used to develop an understanding of a specific problem or an exemplary practice linked to a particular attribute of safety culture.

Leaders at all levels of management consistently provide feedback on the positive behaviour from the perspective of safety culture under the Observation Program. At the same time, they increase employee and contractor motivation by compliments or using other incentive-based instruments. Single and multiple information and visualization campaigns are carried out through communication.

ANNEX 6 EVALUATION OF THE SAFETY PERFORMANCE INDICATORS SET

The Evaluation of the Safety Performance Indicators Set of the National Report of the Czech Republic can be found on the SÚJB website:

https://www.sujb.cz/en/reports

ANNEX 7 IAEA AND WANO MISSIONS IN THE DUKOVANY NPP AND THE TEMELÍN NPP

Chronological list of international missions in nuclear power plants of ČEZ, a. s.

Year	Type	Power plant	Conclusions
1989 / 1991	IAEA: OSART / Re-OSART	Dukovany	Assessment of the nuclear power plant complemented with the fields of maintenance control and implementation, check on the implementation of possible remedial measures. The conclusions from both of the missions at Dukovany NPP were favourable and additional proposals were amended to the final report for further improvement of nuclear safety assurance. These proposals were gradually implemented.
1990	IAEA: Site Safety Review, Design Review	Temelín	Mission aimed at safety assessment of the power plant site and mission focused on the assessment of safety systems, core design and safety analyses. Final reports from the missions include partial recommendations supposed to contribute to nuclear safety enhancement. The recommendations were applied both in the form of changes of and amendments to the design and within the organization of the construction and preparation for future operation.
1990 / 1992	IAEA: Pre-OSART / Pre-OSART Follow-up	Temelín	The Pre-OSART mission focused on practice in the construction of power plant and on preparation of safe operation. The Pre-OSART Follow-up mission assessed the extent to which the recommendations of 1990 were taken into account in the construction and preparation of operation.
1993	IAEA: ASSET	Dukovany	The ASSET mission verified the event prevention system, the so-called “operational events feedback”. The mission rated very favourably the standard of nuclear safety assurance at the power plant.
1993 / 1994 / 1995	IAEA: LBB Application Review	Temelín	Mission on Leak Before Break (LBB) analyses. All missions concluded that LBB methodology was successfully applied at Temelín NPP in compliance with world practices, and that postulated fractures in deterministic analysis are extremely unlikely to occur.
1994	IAEA: QARAT	Temelín	The QARAT mission aimed at verifying the quality assurance area. The group of experts confirmed distinct development in this area.

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1995	IAEA: Safety Issues	Dukovany	Mission to assess specific design solutions of the Dukovany NPP units in connection with safety recommendations identified by IAEA in general for VVER-440/213 units between 1994 and 1995. The mission positively evaluated the approach of Dukovany NPP to the implementation of safety recommendations.
1995	External technical audit	Dukovany	The goal was to evaluate independently the level of nuclear safety assurance at the Dukovany NPP units in agreement with international standards and generally recognized nuclear safety principles. The assessment was performed within the PHARE PH 4.2.9 program by a consortium of West European companies – ENAC (“European Nuclear Assistance Consortium” – 8 Western European Nuclear Design and Engineering Companies) – using the methodology for Periodic Safety Review of nuclear power plants issued by IAEA as Safety Series (SG-012) in cooperation with the SÚJB. The final report contains a set of recommendations focusing particularly on enhancement of the so-called “defence in-depth”, and methodical procedure for this effort.
1995 / 1996	IAEA: IPERS	Temelín	IPERS – a mission on the PSA study took place in 1995 and 1996. The mission concluded that Temelín NPP carefully adopted PSA methodology and the results confirmed a high level of power plant safety in spite of conservative assumptions.
1996	IAEA: ASSET	Dukovany	The mission assessed the event prevention system on the basis of power plant “self-assessment”. The mission finally rated very favourably the standard of nuclear safety assurance at the power plant.
1996	IAEA: Fire Safety	Temelín	The fire protection mission stated that substantial improvements were made in compliance with international trends of fire protection.

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1996 / 2001	IAEA: Safety Issues	Temelín	The mission to assess the safety issues identified by IAEA for nuclear power plants with VVER-1000/320 reactors evaluated the plant's upgraded design, implementation of previously proposed alterations and its preparedness for operation, including issue of compatibility of the original Russian design with proposed and implemented changes, which included the implementation of modern Western technology. In general, the mission highly appreciated ČEZ, a. s. that it had spent a significant effort to improve the Temelín NPP's design and emphasized that the combination of Eastern and Western technologies was carefully considered in the Temelín NPP's design. In the mission's opinion, in some cases such a combination of Eastern and Western technologies resulted in a significant improvement of the safety assurance level in comparison with international practices. The follow-up mission assessed the rate of the implementation of formulated recommendations.
1997	WANO Peer Review	Dukovany	A review of systems and working procedures by INPO criteria. The following fields were reviewed: Organization and Control, Operation, Maintenance, Technical Support, Personnel Training, Chemistry, Radiation Protection, Emergency Planning, and Operating Experience Feedback. The mission positively evaluated Dukovany NPP and presented seven Strengths in six fields.
1998	IAEA: IPERS	Dukovany	A mission to evaluate the first-level PSA study and propose concrete recommendations to improve the study. The final report contained 57 recommendations. All recommendations were analysed in detail in the course of the next three years and adopted recommendations were included into the PSA model and documents.
1998	IAEA: IPPAS	Dukovany	Mission to assess the implementation of the principles of physical protection of nuclear installations into the Czech law and the practice of physical protection as such. In addition, by request of the SÚJB, the national system of physical protection of nuclear materials and nuclear installations was assessed, and the existing practice in the field of physical protection in the Czech Republic and the international recommendations were compared.

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1998 / 2000	WENRA:	Temelín	Nuclear safety assessment in the EU candidate countries. The following is included in the assessment report: the program for Temelín NPP safety enhancement is the most comprehensive one ever used for VVER-1000/320 units, international cooperation has significantly influenced safety improvements (design, operation, safety approvals) and development of safety culture at the plant, combination of Eastern and Western technologies has been successfully handled. The process of combining Eastern and Western technologies was also evaluated by the ENCONET Consulting Company (Austria). The conclusion has been similarly favourable as that by WENRA.
1998 / 2002	IAEA: IPPAS / IPPAS Follow-up	Temelín	The mission focused on the field of physical protection assurance in the construction period. The mission further monitored the implementation process of physical protection technical system, safety analysis preparation and overall concept of the method of physical protection assurance. Final assessment proved that the system meets the international requirements in full. The objective of the follow-up mission was to assess the final state of Temelín NPP physical protection assurance on the level of operated nuclear installation and, additionally present to Temelín NPP recommendations or proposals resulting in improvement of the physical protection system. The mission concluded that technical support of Temelín NPP perimeter is implemented in an outstanding manner, the physical protection system is highly integrated and systematic approaches were used and are still used in implementation of the physical protection system. The physical protection system of Temelín NPP is on the level of the best Western installations and the personnel providing the physical protection system are qualified and professional.
2000	WENRA	Dukovany	Nuclear safety assessment in the EU candidate countries. The assessment of Dukovany NPP resulted in the following: the safety culture is sufficient, safety evaluation and document verification, i.e. periodic safety reviews, are performed using procedures comparable with Western practices.
2000 / 2001 / 2003	IAEA: Pre-OSART / OSART / OSART Follow-up	Temelín	The Pre-OSART missions and the full OSART mission were held in a fast manner. The Follow-up OSART missions followed. A great progress has been generally recognised in enhancing operational safety, implementation of the recommendations and the appearance of the power plant.

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2000	IAEA: Preparedness and Commissioning Review Mission	Temelín	The objective of the mission was to assess operational practices in the field of Management, Organization and Control, Operation, Maintenance and Commissioning. The mission concluded that the systems are handed over and under control of operating organization in condition suitable for power plant commissioning.
2001	AQG	Dukovany	An assessment of nuclear safety level of nuclear installations in the candidate countries was performed by WPNS group ("Working Party on Nuclear Safety") established at the AQG in connection with preparation for the EU enlargement. The report drawn up by this group in relation to Dukovany NPP recommended to the Czech Republic to submit a report on measures adopted in order to complete assessment of complete verification of the bubbler condenser behaviour at units 1 – 4 for all design accidents. Verification of the bubbler condenser was completed towards the end of 2003 within PHARE projects and the joint project of the consortium of Bohunice, Dukovany, Mochovce and Paks nuclear power plants. Work executed within the projects proved functionality of the bubbler condenser of all Dukovany NPP units for all design accidents. The SÚJB evaluated report of the consortium together with the results of the OECD-NEA BC (Bubble-Condenser) Steering Group Activity Report and accepted conclusions included in these reports. Based on the SÚJB inspection focused on present condition of all subsystems of the containment system, their qualification and maintenance documents as well as on present status of all modifications prepared and implemented by the power plant based on BCEQ ("Bubbler Condenser Experimental Qualification") projects results, the SÚJB considers the updated demonstration of Dukovany NPP containment system availability to carry out its function during the accident and after the accident throughout design life span of the power plant sufficient, for all design accident types.
2001 / 2002	AQG:	Temelín	Two recommendations were included in the AQG report in relation to Temelín NPP: to assure assessment proving sufficient protection against high-energy pipe break and potential subsequent damage to steam line and feedwater piping (short-term priority), and inform on measures to complete the proof of reliable function of important by-pass valves to atmosphere and safety valves at dynamic load with steam-water mixture flow. A report on implementation of these recommendations, which were adopted, was submitted to the European Commission.

2001 / 2003	IAEA: OSART / OSART Follow-up	Dukovany	The power plant control areas, personnel quality, equipment and order condition were evaluated at a high standard, and the working procedures and regulations area was evaluated as average. The control of compliance with the Recommendations and Proposals verified that Dukovany NPP personnel performed a through going analysis and its solution of operational safety enhancement exceeded in many cases the extent of original recommendations from the team. In respect to solution of findings included in the original report, the power plant made great progress and the team in the Follow-up mission classified many of these findings as fulfilled.
2003	IAEA: IPSART	Temelín	The IPSART mission followed up the previous IPERS reviews and focused in detail on updated models of probabilistic safety assessment of the current design and operation of the power plant. A six-fold decrease in occurrence of the event resulting in reactor core damage was declared by means of these new probabilistic assessment models for internal initiation events.
2003	IAEA: Site Seismic Hazard Assessment	Temelín	The mission resumed partially the mission held in 1990. It was stated that local seismic monitoring network was built in response to the recommendations in the vicinity of Temelín NPP. The mission concluded that acceleration value of 0.1 g for seismic level SL2 is an adequate value for Temelín NPP.
2004 / 2006	WANO Peer Review / WANO Peer Review Follow-up	Temelín	The mission reviewed the following fields: Organization and Control, Operation, Maintenance, Technology, Radiation Protection, Operating Experience, Chemistry, and Fire Protection. The WANO team classified Temelín NPP as having a good operation safety enhancement program, good and experienced personnel, and found no fundamental safety-important deficiencies and suggested 13 areas for improvement. The follow-up mission assessed six areas for improvement as completed in full and seven areas for improvement as areas with satisfactory improvement, but with uncompleted activities. At the same time, the mission submitted its proposals for further continuation in such fields.

2007 / 2009	WANO Peer Review / WANO Peer Review Follow-up	Dukovany	The following fields were reviewed: Organization and Control, Operation, Maintenance, Technical Support, Radiation Protection, Operating Experience Feedback, Chemistry, and Personnel Training and Qualification. Of these eight fields, the mission defined 7 Good practices, 3 Strengths and 12 Areas for improvement. The follow-up mission evaluated three Areas for improvement as resolved, eight Areas were classified with satisfactory progress and one Areas was evaluated as being settled with a small progress.
2008 / 2011	IAEA: SALTO / SALTO Follow-up	Dukovany	A Peer Review mission on the topic of safe long-term operation (SALTO) to review the programs/activities o the power plant. The mission assessed the activities performed by the power plant concerning SALTO and control of ageing of systems, structures and components important to safety. For preparation of long-term operation of Dukovany NPP, the mission defined 11 Suggestions and 12 Recommendations in 19 sub-areas. The follow-up mission evaluated their solutions. The mission found four Recommendations in the finished status, satisfactory progress of the solution for remaining eight Recommendations, seven Proposals finished and satisfactory progress of the solution for the remaining Proposals.

2011 / 2012	ENSREG Stress Tests / Country Review (Follow-up Fact Finding Visit)	Dukovany Temelín	The so-called “Stress Tests” were carried out according to the ENSREG specification – focused review of safety margins of NPPs in connection with the events that occurred at the Fukushima NPP, i.e. extreme natural events seriously endangering safety functions and leading to severe accidents. This review included: • Evaluation of NPP response to a set of extreme situations and their possible concurrence. • Evaluation of preventive and mitigating measures selected on the basis of defence-in-depth philosophy: initiating events, subsequent loss of safety functions, severe accidents management. Results of Stress Tests were summarized in the Final Report[18] and through the National Report of the Results of Stress Tests of Czech Nuclear Power Plants[19] submitted to experts appointed by ENSREG for assessment. As the second phase of independent safety assessment of NPP, the so-called “Country Review”, i.e. Follow-up Fact Finding Visit, was subsequently carried out at the SÚJB in Prague and at Dukovany NPP and Temelín NPP. Results of the review of safety margins and resistance of NPP, required by the European Council, confirm efficiency and appropriateness of adopted decisions to implement measures resulting in improved resistance of the original design. No issue was identified which would require an immediate action. The power plant is capable to manage safely highly improbable, extreme emergency situations, without a risk for the surrounding areas. Based on the results of Stress Tests, an Action Plan to improve safety was drawn up for both Czech NPPs. This included a number of corrective measures, some of which were proposed before the events at Fukushima NPP and the Stress Tests confirmed their appropriateness.

[18] http://www.cez.cz/edee/content/file/energie-a-zivotni-prostredi/dukovany/zaverecna-zprava-zt-edu.pdf
[19] https://www.sujb.cz/fileadmin/sujb/docs/dokumenty/National_Report_Revision_1_for_web_1.pdf

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2011 / 2013	IAEA: OSART / OSART Follow-up	Dukovany	The areas of Training and Qualification, Radiation Protection and Chemistry, etc., including Emergency Preparedness were evaluated very well. The mission presented to the power plant 3 recommendations, 11 areas for improvement and 10 good practices subsequently recommended by IAEA to other operators of nuclear power plants at the international website. Control of the implementation of the recommendations and proposals of this mission was carried out by the Follow-up OSART mission in 2013, when it was stated complete settlement of the defined areas for improvement in nine cases and a clear progress towards a final solution in other five cases.
2011 / 2013	WANO Peer Review / WANO Peer Review Follow-up	Temelín	WANO experts positively evaluated the high professionalism of personnel and the achieved safety level of power plant. The mission summarized its findings in the form of 17 areas for improvement and 3 good practices for other NPP operators all over the world. The follow-up mission assessed the degree of implementation of the recommendations with the result: for two areas for improvement, satisfactory level of solution has been stated (most or all corrective measures were completed); for 13 areas for improvement, the pending level has been stated (some deficiencies still exist), and for two areass for improvement, the level at risk has been stated (little or no improvement).
2012 / 2014	WANO Peer Review / WANO Peer Review Follow-up	Dukovany	Another mission WANO Peer Review was focused on the safe operation of power plant and special attention was given to SOERs (Significant Operating Experience Report), in particular to those issued in connection with the events occurred in Fukushima Daiichi NPP. Foreign experts presented 19 areas for improvement as well as four good practices and five strengths. The follow-up mission stated a satisfactory level of solution for five areas for improvement and the pending level for 14 areas for improvement.
2012 / 2014	IAEA: OSART / OSART Follow-up	Temelín	Another mission OSART took place in November 2012 and examined 9 areas: Organization and Management, Operation 1, Operation 2, Maintenance, Technical Support, Feedback, Chemistry, Radiation Protection, and Accident Management. Five recommendations and six areas for improvement as well as six good practices were formulated. The follow-up mission assessing the implementation progress of the recommendations and proposals stated the full settlement of defined areas for improvement in five cases and a clear progress towards a final solution in other six cases.

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2014 / 2016	IAEA: SALTO / SALTO Follow-up	Dukovany	Assessment of readiness of the Dukovany NPP for an extended operation beyond design life (see Annex 3 to the National Report of the Czech Republic of 2016). This mission formulated two recommendations and six areas for safety improvement. The follow-up mission reviewed the state of implementation of the proposals.
2016	IAEA: TSR PSA	Dukovany	Mission to improve the quality of PSA and Safety Monitor models, and increase their suitability for risk-informed applications.
2017	WANO Peer Review	Dukovany	Another WANO mission was conducted fully in accordance with new Performance Objectives and Criteria.
2015 / 2017	WANO Peer Review / WANO Peer Review Follow-up	Temelín	WANO Peer Review according to the new Performance Objectives and Criteria; the mission have identified 14 areas for improvement. The follow-up mission assessed how the power plant addressed the recommendations.
2017/ 2019	WANO Peer Review / WANO Peer Review Follow-up	Dukovany	WANO Peer Review according to the new Performance Objectives and Criteria; the mission have identified 9 areas for improvement. The follow-up mission assessed how the power plant addressed the recommendations.
2019	WANO Peer Review	Temelín	WANO Peer Review according to the new Performance Objectives and Criteria; the mission have identified 10 areas for improvement.
2021	WANO Peer Rewies	Dukovany	WANO Peer Review according to the new Performance Objectives and Criteria 2019-1; the mission have identified 9 areas for improvement.
2021	IAEA: IPPAS	Dukovany Temelín	

ANNEX 8 RESEARCH NUCLEAR INSTALLATIONS

This Annex has been elaborated beyond the scope of obligations resulting from the Nuclear Safety Convention. The Annex contains description and safety of the research reactors in the Czech Republic.

Description of the current situation

The nuclear program in the Czech Republic has been supported since the beginning of its development by the domestic experimental base. The main role in this base has been played by the ÚJV Řež, which was established in 1955, and its subsidiary company Centrum výzkumu Řež. A significant part of the experimental part of the scientific-research base has been research reactors. To assure financing of further operation of research reactors in ÚJV Řez, a. s., since 1st January 2010 both reactors including operating personnel were transferred to subsidiary company Centrum výzkumu Řež that fulfils the conditions for financing from governmental sources.

Based on the Act on State-governed Surveillance of Nuclear Safety (issued in 1984), the research reactors have been subject to a similar regulatory regime as the nuclear power plants and other nuclear installations, using a graded approach (approval process, submission of safety-related documentation – safety reports, Limits and Conditions, etc.), and have been subject of the inspections carried out by State Office for Nuclear Safety, which also issues authorizations for main control room personnel. This regulatory regime was further strengthened by issuing the Atomic Act in 1997 and its subsequent amendments, and by issuing the new Atomic Act in 2016 and its implementing regulations.

In 2004, the SÚJB issued the Safety Guide – Requirements for research reactors for assurance of nuclear safety, radiation protection, physical protection, and emergency preparedness, which superseded the SÚJB Decree No. 9 of 1985. The IAEA recommendations issued in 2003 and experience from construction and operation of the research nuclear installations in the Czech Republic and worldwide were used in its preparation. A new Safety Guide for research reactors is currently being prepared following the new Atomic Act and its implementing regulations.

Operators of all nuclear research installations, in accordance with IAEA recommendations perform self-assessment of the safety of research reactors and other facilities and regularly inform the SÚJB on operational results and events based on agreements.

Nuclear research facilities are operated as large research infrastructures in the open access mode supported by the Ministry of Education, Youth and Sports as part of the projects “Experimental Nuclear Reactors LVR-15 and LR-0” (identification code LM2018120), which includes LVR-15 research reactor and LR-0 critical assembly, and “VR-1 – Training Reactor for Research Activities” (identification code LM2018118), which includes the VR-1 training reactor at the Czech Technical University.

Overview of research reactors

LVR-15 Research Reactor in Centrum výzkumu Řež

The construction of the reactor originally called VVR-S commenced in 1955 and the reactor was put into operation on September 24, 1957. Its thermal power was 2 MWt. The reactor served as a multi-purpose research reactor for the Czechoslovak nuclear program and the national economy. The reactor was used to produce radioisotopes, irradiate materials and for scientific research in the reactor physics area. Its output was increased to 4 MWt in 1964. Essential reconstruction took place in 1989 when all equipment including the reactor vessel was replaced. Transition to highly enriched fuel IRT-2M (80 %) was performed and the output was increased to 8 MWt. In 1994 the maximum allowed power output was increased to 10 MWt and the reactor utilisation was increased by the transition to three-week campaign.

The construction of several experimental loops in the nineties significantly increased the experimental possibilities of the LVR-15 reactor. The loops simulate conditions in the PWR and BWR reactors and thus allow testing of construction materials under real conditions. In 1995, the reactor switched to fuel with lower enrichment (36 %).

At present, the LVR-15 reactor is ranked among several active material testing reactors in Europe. Besides material research (reactor vessel materials irradiation, corrosion tests of primary circuit materials and core internals) and tests of primary circuit water regimes, the reactor is employed also used to perform neutron activation analysis, produce radiopharmaceutical isotopes, produce radiation-doped silicon for electrotechnical industry, for irradiation service and scientific research of material properties in horizontal channels.

Since 2000 the reactor was ranked among several workplaces in the world dealing with neutron capture therapy for brain tumours. This project was interrupted due to a lack of funds.

In 2006, the ageing management program of selected reactor components was initiated and focused on extending of operating lifetime of the research reactor after 2028. This intention is supported by very good operational results of the LVR-15 reactor, the results of last five-year cycle of operational inspections in 2012 and the results of the ageing management program.

Since 2005, the Czech Republic has joined to global initiative of the USA, Russia, and IAEA GTRI (Global Thread Reduction Initiative) which aims to reduce the risk of abuse of nuclear and radioactive materials for terrorist attacks. Under this Initiative, highly enriched spent and fresh fuel of Russian origin was returned to the Russian Federation (RRRFR, Russian Research Reactors Fuel Return) and fuel enrichment in research reactors was reduced below 20 % (RERTR, Reduction of Enrichment from Research and Test Reactors). The IRT-4M type fuel with the enrichment of 19.7 % is currently used in the reactor.

At the end of the year 2014, the LVR-15 reactor protection and control system was replaced by a new modern digital reactor control and protection system based on the authorization of the SÚJB.

In 2010, the production of ^{99}Mo by irradiating samples containing uranium enriched to 89–93 % ^{235}U in the LVR-15 reactor was started and commercial irradiation of low-enriched targets to produce ^{99}Mo for medical purposes has been underway since May 2016.

In the years 2012 to 2017, new experimental loops were implemented in the reactor in the framework of the SUSEN project, which is one of the projects under the Research and Development for Innovations Operational Programme.

Construction of a supercritical pressurized water fuel loop SCWL-FQT (Super Critical Water Loop – Fuel Qualification Test) with closed forced water circulation was completed; its active channel is planned to be placed in the future as a part of the LVR-15 research reactor. The loop is intended for research in the field of supercritical water. It is a general-purpose facility focusing on research activities in the field of material research, chemical regimes research and nuclear fuel cladding testing for supercritical water-cooled reactors in generation IV.

Another equipment in the framework of the SUSEN project is a helium experimental loop HTHL 2 containing high-temperature helium with the possibility of material testing for in-core components at simultaneous effects of helium with high temperature up to 900°C, radiation, and mechanical stress.

In 2019, the LVR-15 reactor systems underwent several innovations and reconstructions, such as the replacement of pressure sensors in selected instrumentation and control circuits, the installation of replacement absorbers for UR70 control rods, the reconstruction of the roof cladding of reactor building, the replacement of secondary heat exchangers and related cooling technology or the start of reconstruction of stationary dosimetry system. Based on the assessment in the area of ageing management, special endoscope inspections were performed under the support grate of the vessel in order to evaluate the overall condition of the reactor vessel, inspections of buried piping of the reactor secondary circuit and analysis of the state of the witness program for the evaluation of the service life of the connection of horizontal channels and the reactor vessel. In 2020, the reconstruction of the stationary dosimetry system and the replacement of station batteries were completed. The permit to change the power supply to the reactor coolant pump and to modify the emergency chain was issued by the SÚJB.

Since June 2020, the Office has conducted administrative procedures concerning the licence to operate the LVR-15 research reactor and to approve the documentation for the licensed activity. An extensive set of submitted documentation (Final Safety Analysis Report, Management System Program, Ageing Management Program, Certificate of Readiness of Installation, Personnel and Internal Regulations and other documentation for licensed activities) was reviewed by a multidisciplinary team of assessors as part of the administrative procedure. The issued decisions regarding the licence for operation are valid for an indefinite time and contain several conditions to be met by the operator once or continuously and the status of their fulfilment must be notified to the Office. The Office also assessed the relevant parts of the chapters of the final safety analysis reports, which related to PSA and its use in the operation of the LVR-15 reactor.

From 18 to 25 August 2020, the INSARR mission took place at the LVR-15 reactor, the aim of which was to assess the current state of the facility and personnel and to evaluate the inclusion of comments from the previous mission. This took place in 2003. The LVR-15 mission was the first mission since the start of the COVID-19 pandemic.

The six-member team included not only IAEA staff, but also experts from Argentina, the Netherlands, and the Slovak Republic. The members evaluated not only the organization and management, but also the technical aspects. These included, for example, safety analyses, operation and maintenance programs, radiation protection or experimental equipment of the reactor.

Mission members appreciated the effectiveness of ensuring the administration and safe operation of the installation during the pandemic. They also found improvements not only in training plans and equipment maintenance, but also in generational renewal of personnel.

Despite this, the mission recommended further enhancing the safety of the LVR-15 reactor. The main areas for improvement include strengthening the organizational structure and clearly defining the roles and responsibilities of employees, increasing the effectiveness of the Committee on Safety within the Centrum výzkumu Řež by expanding its competence. Finally, work procedures should be developed, including new experiments, modifications, or operational safety programs. According to the final report of the IAEA team, abnormal procedures should also be improved. The standard operation should be supplemented and improved, in particular, in the framework of the instructions for workers and radiation monitoring practices.

Since 2019, the LVR-15 reactor has also been under preparation for periodic safety review, which is planned for 2023.

LR-0 Critical Assembly in Centrum výzkumu Řež

The LR-0 critical assembly LR-0 was created by reconstruction of the heavy-water TR-0 critical assembly, which was constructed in ÚJV Řež and most of its equipment was manufactured in former Czechoslovakia. The reactor was used to perform research on the reactor core of the NPP A-1 (HWGCR) in Jaslovské Bohunice. The reactor was put into operation on June 21, 1972, and was operated until 1979.

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In connection with the transition of the Czechoslovak nuclear program to NPPs with VVER pressurized water reactors, the TR-0 was reconstructed into the LR-0 experimental light water reactor with zero power output. The physical start-up of the LR-0 reactor took place on December 19, 1982, and the reactor was put into continuous operation in 1983. The maximum allowed power output of the reactor is 5 kWt and it is operated using shortened fuel assemblies of VVER-1000 and VVER-440 reactors.

The LR-0 reactor is used to perform research on core physics (it has variable distance parameter of a reactor fuel lattice), storage racks and to simulate neutron fields in the power reactors. The reactor can be controlled using absorption rods, boric acid and moderator level.

As part of the modernization of the LR-0 reactor, the I&C system was innovated to a digital version based on the SÚJB license in 2007, with a strict separation of operating and safety systems.

The SÚJB licensed operation of the LVR-0 and LVR-15 reactors to the Research Centre Řež, in 2010, with validity until 31 December 2020. Centrum výzkumu Řež launched negotiation with the SÚJB and preparation to apply for the licence to continue the operation of the LR-0 and LVR-15 research reactors after 2020.

Since June 2020, the Office has conducted administrative procedures concerning the licence to operate the LR-0 reactor and to approve the documentation for the licensed activity. An extensive set of submitted documentation (Final Safety Analysis Report, Management System Program, Ageing Management Program, Certificate of Readiness of Installation, Personnel and Internal Regulations and other documentation for licensed activities) was reviewed by a multidisciplinary team of assessors as part of the administrative procedure. The issued decision regarding the licence for operation is valid for an indefinite time and contains several conditions to be met by the operator once or continuously and the status of their fulfilment must be notified to the Office.

In 2019, experiments were carried out on the configuration of the loading zone with an iron reflector and graphite centre to verify critical states and power distribution. In the second half of the year, critical experiments, measurements of spectra and activation detectors were carried out, and an additional experiment was carried out in the area of zero reactor kinetics and delayed neutrons.

In the first half of 2020, experiments were carried out on the configuration of the loading zone with graphite, silicon and air and with a graphite, silicon, water and iron reflector to verify critical states and power distribution by measuring fission products in fuel and using activation detectors. To evaluate the effect of the heavy reflector, measurements were repeated on the zone misaligned to the close vicinity of the core basket. In the second half of the year, the operation continued in this configuration through measurements in the loading zone filled with graphite, air, PVC and NaCl to evaluate the effective cross-sections of neutron reactions on chlorine for Generation 4 fast reactors cooled with chloride salts.

In the first half of 2021, experiments were carried out in the so-called “loading zones”. Most of the experiments were on new configurations, and a total of 17 basic critical experiments were implemented. Furthermore, experiments were performed on the FLiBe hot salt configuration and with various graphite configurations. In the second half of the year, experiments were carried out in cooperation with the CEA (Atomic Energy Commission, France) - measuring the kinetic parameters of the reactor using the Feynman-alpha method in noise mode. In particular, critical experiments, spectra measurements, fission products gammagraphy and measurements with activation detectors were performed on all the above configurations. Furthermore, the core was modified to seven assemblies for measuring the effectiveness of Sm and Hf absorbent materials in cooperation with the University of West Bohemia in Pilsen and the “Maketa 1000” configuration for measuring fission density distribution using gamma spectroscopy of fuel rods in the framework of the ČEZ R&D project (applied research and experimental development).

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VR-1 Training Reactor at ČVUT - FJFI

The VR-1 training reactor was commissioned on December 3, 1990, at ČVUT (Czech Technical University) – The Faculty of Nuclear Science and Physical Engineering. The reactor uses the IRT-M fuel, and all its equipment was manufactured in former Czechoslovakia. The reactor is used in the training process of university students, in scientific activities and for the preparation of specialists of the Czech nuclear power program. The training reactor is involved in international cooperation (TEMPUS, ENEN and NEPTUNO programs) and cooperates with similar training reactors in UK, Netherlands, and Austria.

In October 2005, the 36 % enriched fuel (HEU) of the VR-1 reactor was exchanged for fuel enriched below 20 % (LEU). The VR-1 reactor thus became the first reactor with IRT-M type Russian fuel, for which such exchange was executed within the RERTR program.

Innovation of the hall-type crane and complementation of the HMI system (Human–Machine Interface) of the reactor with the electronic recording function for shift operational inspections took place in the summer of 2011.

Reconstructions of the support structures for the demineralization station in the VR-1 reactor hall took place during the summer outage in 2014.

Innovation of the tubular post system and the moderator circulation system in the H02 tank took place during the summer outage of 2015.

The SÚJB granted the license for operation of the VR-1 training reactor to the Czech Technical University in 2017, in compliance with the Atomic Act, i.e., for an indefinite time.

In 2019, a new source – a mixture of ^{155}Eu and ^{22}Na was introduced at the reactor workplace.

In 2020, two modifications took place at the VR-1 reactor, consisting of the removal of a new type of absorption rod from the H02 vessel and the installation of a new demineralization station, including the dismantling of the existing station.

In 2021, there was a transition from PMV measurement to Campbell-type measurement.

VR-2 Training Subcritical Assembly at ČVUT – FJFI (Czech Technical University – Faculty of Nuclear Science and Physical Engineering)

In November 2019, at the request of the Czech Technical University in Prague, an administrative procedure was initiated for the permit to place the VR-2 subcritical assembly at the Department of Nuclear Reactors of the Faculty of Nuclear Sciences and Physical Engineering. The administrative procedure included an assessment of the submitted Initial Safety Analysis Report and other documentation for the licensed activity. The applicant was requested to provide the missing information, gradually eliminated all identified deficiencies in the application and submitted documentation and met the conditions for performing activities under the Atomic Act. The decision on the permit was issued on 3 November 2020.

The administrative procedure was subsequently initiated for the permit for construction of the VR-2 subcritical assembly based on the application dated 15 February 2021. The administrative procedure was terminated on 11 March 2022 by issuing the relevant permit.

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ŠR-0 Research Assembly in Plzeň

In 1971 the ŠR-0 light water research assembly with zero power output was put into operation at ŠKODA Plzeň. The original allowed power output of the system of 100 Wt was increased in 1975 to 2 kWt. This reactor was decommissioned in 1992.

Conclusion

All nuclear research reactors operated in the Czech Republic are operated in compliance with IAEA recommendations – "Safety of Research Reactors" (SRR-3) and "Code of conduct on the safety of research reactors" and with other existing and being prepared Safety Standards for the research reactors.

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