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THE CZECH REPUBLIC NATIONAL REPORT

under the Convention on Nuclear Safety

Prague 2016

THE CZECH REPUBLIC NATIONAL REPORT under the Convention on Nuclear Safety
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Introduction

This Report is the Czech Republic National Report prepared 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, 2016. 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. 5 of 16 January 2015.

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.

The basic philosophy and principles of nuclear safety 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 type, 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 reactors is included in the Annex 8.

List of Abbreviations

AOP	Abnormal Operating Procedure
AOT	Allowed Outage Time
AQG	Atomic Question Group
ASSET	Assessment of Safety Significant Events Team
Atomic Act	Act No. 18/1997 Coll., on Peaceful Utilisation of Nuclear Energy and Ionising Radiation, as amended
CDF	Core Damage Frequency
ČEZ, a. s.	Business name of the Czech utility - joint stock company ČEZ, a. s.
CI	Central engineering
ČHMÚ	Czech hydromeoterological institute
EDU	Dukovany NPP
EGP	Energoprojekt Praha
EMS	Environmental Management System
ENSREG	The European Nuclear Safety Regulators Group
EOP	Emergency Operation Procedure
EU	European Union
ETE	Temelín NPP
ESW	Esential service water
FDF	Fuel Damage Frequency
PP	Physical protection
HP	Emergency preparedness
HPES	Human Performance Evaluation System
HZS	Fire Rescue Service
I&C	Instrumentation and control
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiation Protection
INES	International Nuclear Event Scale
INPO	Institute of Nuclear Power Operators
INSAG	International Nuclear Safety Advisory Group
IPPAS	International Physical Protection Advisory Service
IPSART	International Probabilistic Safety Assessment Review Team
IPERS	International Peer Review Service
IRS	Incident Reporting System
ISO	International Standard Organization

IZS	Integrated rescue system
NS	Nuclear safety
NPP	Nuclear Power Plant
LaP	Limits and conditions
LBB	Leak Before Break
LERF	Large Early Release Frequency
LTO	Long Term Operation
MCR	Main control room
NUREG	Regulatory guides, from the US Nuclear Regulatory Commission
NS-G	Safety Guide IAEA
OBK	Civil Safety Commission
OECD-NEA	Organisation for Economic Co-operation and Development – Nuclear Energy Agency
OIK	Civil Information Commission
OSART	Operational Safety Review Team
PHARE	Technical Assistance Program organized by the European Commission
PpBZ	Final Safety Report
PSA	Probabilistic Safety Assessment
PSR	Periodic Safety Review
QARAT	Quality Assurance Review Assistance Team
QLV	Quality of Human Performance
RAO	Radioactive waste
RHWG	Reactor WENRA Harmonizing Group
SALTO	Safe Long Term Operation
SAMG	Severe Accident Management Guidelines
SG	Steam generator
SÚJB	State Office for Nuclear Safety
SÚJCHBO, v.v.i.	National Institute for Nuclear, Chemical and Biological Protection
SÚRAO, v.v.i.	Radioactive Waste Repository Authority
SÚRO	National Radiation Protection Institute
SSC	Systems, structures and components
SW	Software
TPS	Technical Advisory Group
ÚJV Řež, a. s.	Nuclear Research Institute in Řež - joint stock company ÚJV, a. s.
UPS	Uninterrupted power supply
ÚRAO	Radioactive waste disposal facility
US NRC	US Nuclear Regulatory Commission
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 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, 2016. The structure of the National Report is based on recommendations approved at the preparatory meeting of parties to the Convention in September 1995 and published as "Guidelines Regarding National Reports under the Convention on Nuclear Safety", INFCIRC/572/Rev.5.

Since last National Report, compiled in April 2013, 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:

On request of the Czech Republic, the International Atomic Energy Agency (IAEA) conducted an assessment from 18 to 29 November 2013 in order to assess supervisory activities performed by SÚJB in the field of regulation of nuclear technology risks including assessment of the legislative framework for this field see Chapter 8.2.4.

The review of supporting documents to the application of ČEZ, a. s., for licence for siting of two new nuclear power units 3 and 4 in the Temelín site was concluded in 2014 by issuing SÚJB decision. Assessment of the application and technically difficult evaluation of the documents, extensive studies and analyses proving the characteristics of the site in question and the concept of the project of the nuclear units under consideration were conducted in accordance with the Atomic Act and pursuant to the Administrative Code. For further details see Chapter 17. Although this plan e was finally postponed by the ČEZ, a. s., the SÚJB continues to monitor compliance with the conditions of the decision issued, in particular in the field of site evaluation.

In line with the National Action Plan, the implementation of the measures resulting from the stress tests carried out continued.

For example, several process systems were added at the Dukovany NPP (for example, diverse SG feedwater system, diverse make-up system of the depressurized primary circuit and spent fuel pool with connection to the boron concentrate tanks and the tanks of low-pressure emergency system pumps). The installation of diverse power supply units, which were tested by parallel running into the network and island operation with the charging pumps under load, was completed. The new mobile alternative diesel-generator sources were tested too by testing the power supply of one of the above mentioned pumps.

Several process systems were added at the Temelín Nuclear Power Plant (Temelín NPP) (for example, diverse SG feedwater system, diverse make-up system of the depressurized primary circuit and spent fuel pool with connection to the boron concentrate tanks and the tanks of low-pressure emergency system pumps). The installation of diverse power supply units, which were tested by parallel running into the network and island operation with the charging pumps under load, was completed. The new mobile alternative diesel-generator sources by testing the power supply of one of the above mentioned pumps.

The operator managed to conduct the actions in accordance with the dates set by the National Action Plan and in the adequate quality; most of the additionally installed equipment are ready to fulfil the intended functions. Therefore, the progress of the Action Plan was successfully justified at further international assessment of the progress of such plans, which was organized by the European Commission in April 2015.

Significant weaknesses in the executing of non-destructive testing at both nuclear power plants occurred during the second half of 2015. Poor-quality X-ray testing was identified by the SÚJB at the Dukovany NPP in the framework of the inspection, which was carried out by the SÚJB in a period from April to August 2015. In addition to information in Article 14, these issues are addressed in separate Annex 4 to the National Report. Among others, this case raises the question whether the inspections carried out by the SÚJB in previous years were sufficient and whether the given weaknesses could not be identified earlier. Activities of the months ahead will be also focused on detailed analyses and on finding the possibilities for further increasing the effectiveness of SÚJB's inspection activities.

In 2015, the application for the licence to continue operation of Dukovany NPP Unit 1 was submitted by the ČEZ, a. s. The licence was issued by the SÚJB on 30 March 2016 and became final on 1 April 2016. The application for the licence to continue operation of Dukovany NPP Unit 2 will be submitted by the ČEZ, a. s., in the second half of this year and for Dukovany NPP Units 3 and 4 in 2017. An extended review of all relevant areas including evaluation of the results of the Periodic Safety Review (PSR) preceded the issuing of the licence. The year 2015 was also the year of completion of new comprehensive legislation for peaceful utilisation of nuclear energy and ionising radiation that shall replace the existing Atomic Act and it's implementing legal regulations.

Changes in the SÚJB related to Act No. 234/2014 Coll., on Civil Service began during 2014. This Act was published in the Collection of Laws of the Czech Republic on 6 November 2014 and entered into full force on 1 January 2015. In particular, it regulates the legal relationships of public employees performing state administration in administrative bodies and marks a significant step towards the introduction of stable and professional state administration. The Civil Service Act applies to public employees, who perform state administration in administrative bodies. Over 171 employees took an oath of allegiance and were employed to perform public service in the SÚJB last year. Other employees work under the labour legal scheme.

The age structure of the SÚJB's employees remains virtually the same. In 2015, the average age of employees was 50.17 years, of that 48.12 was attributed to women and 52.33 to men. The long-term comparison shows that staffing of SÚJB is relatively stabilised but 12 employees retired and other 13 employees terminated their employment with the SÚJB (of which two during the probationary period) at the year end. Such retirements and departures exercised a pressure on the recruitment of the relatively high number of new employees, which can be, particularly in technical positions, resolved only over a long period of time.

The following priorities are set for 2016, for the fields addressed herein:

- Adopting the new Atomic Act and issuing more than two tens of implementing legal regulations associated therewith; intensively supporting the implementation of the new atomic legislation into practice, including learning and information events for the non-expert and professional public; issuing new guides and recommendations.
- Promoting the need for awareness of safety culture priority across the SÚJB and promoting it for all the entities under inspection. In the framework of inspections, focus on gathering data on the safety culture.
- Increased emphasis on human resources development, on professional development of employees, on the transmission of knowledge and experience in case of generational renewal.
- Providing the stable specialised independent technical support (TSO – Technical Support Organization) for evaluation and inspection activities of the SÚJB.
- Continuing the readiness assessment of other units of the Dukovany NPP for LTO.
- Support and further training of radiation protection experts in accidental exposure conditions.
- Starting to conduct regular exercises aimed at conducting forecasts and issuing recommendations to adopt protective measures for various types of accidents.
- Preparing for the follow-up IAEA IRRS mission.
- Increasing the SÚJB's credibility, as much open public communication as possible.

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 four VVER-440/213 reactor units in Dukovany NPP and two VVER 1000/320 reactor units in Temelín NPP operated in the Czech Republic. Geographic locations of both the Czech nuclear power plants are shown in Fig. 6-1. Technical data of both NPPs and main changes in their designs to date can be found in the Annex 1.

Since early 1990s, nuclear 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 IAEA and WANO missions as well as nuclear safety assessment within the framework of accession of the Czech Republic to the European Union through the WPSN group established at the AQG following the assessment according to the 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.

In accordance with 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 continuous monitoring 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 – see Chapter 13.4, international missions – see Chapter 6.3, 6.4 and Annex 3.

Based on these assessments, measures are adopted to enhance the safety of nuclear installations – e.g. the National Action Plan (see Annex 9), implementation of the Accident Management (see Chapter 19.4), Programs for Safety Enhancement.

The programs for safety enhancement of nuclear power plants are the documents containing safety-related modifications/projects. These programs are updated each year, taking into account the inputs from stress tests, PSR, internal and external feedback, international missions, benchmarking, national legislation, LTO, PSA, and other sources.

Following the experience from other nuclear installations and energy companies, the IAEA also initiated the review of the "leading to safety" in the form of the so-called "OSART Corporate". The first review of this topic took place in the Czech Republic in September 2013. The follow-up review took place in May 2015 (see Annex 3).

An IAEA mission took place in the Czech Republic in 2013 to assess seismic hazard for nuclear power plant sites with special emphasis on the Temelín NPP. The main objective of the IAEA mission was to assess the correctness and timeliness of the methodology for seismic risk assessment IAEA SSG-9 ("Specific Safety Guide"), which is currently being applied for nuclear power plant sites in the Czech Republic. The IAEA team assessed the implementation status of recommendations from the previous seismic mission conducted by the IAEA (February 2003) and assessed compliance the methodology used by the Czech experts with the IAEA standards and to the present world practice. The mission concluded that steps has been taken to fulfil part of the recommendation and the extent of further activities have been specified to continuously precise the seismic hazard.

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.

The above mentioned safety assessments show that in practice, that the level of nuclear safety in currently operated nuclear power plants on the territory of the Czech Republic complies with the high safety standards. The new legislation, which would enter into force in 2017, incorporates 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 early and large radiation release that will not allow for local or time restrictions for the immediate measures imposed. This requirement will be also applied to currently operated units to a practicable extent.

Information on the significant events that occurred at the Dukovany NPP and at the Temelín NPP in the past three years is presented in Chapter 14.

6.3 Dukovany NPP

6.3.1 Overview of international nuclear safety assessments performed and their main conclusions

Nuclear safety assurance level at Dukovany NPP has been assessed continuously.

IAEA mission

OSART:

First OSART mission took place in September 1989 and a re-assessment Re-OSART mission followed in November 1991. The objective of the missions was to complement assessment of the nuclear power plant with the field of maintenance control and implementation, and subsequently to 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 [6−1], [6−2].

Another OSART mission took place in 2001. 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. Fulfilment of the Recommendations and proposals resulting from this mission was checked by the Follow-up OSART mission in 2003. The mission team found that Dukovany NPP personnel performed an 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 classified many of these findings as fulfilled [6−3].

Third OSART mission took place in 2011. The areas of Training and Qualification, Radiation Protection and Chemistry, etc., including Emergency Preparedness were evaluated very well. [6-4]. The mission presented to the power plant 3 recommendations, 11 proposals for improvement and 10 good practices to be recommended to other operators of nuclear power plants on the international website. Implementation of the recommendations and proposals resulting from this mission was checked by the Follow-up OSART mission in 2013 (see Annex 3).

<u>ASSET:</u>

The ASSET mission took place in October 1993 in order to verify the event prevention system, the so-called “operational events feedback”. This mission was followed by another ASSET mission in 1996 to evaluate the event prevention system based on the plant's self-assessment. Conclusions from both missions rated very favourably the standard of nuclear safety assurance at the power plant [6-5], [6-6].

<u>Safety Issues:</u>

A mission evaluating Safety Issues was organized in 1995 in order 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 in 1994-1995. The mission appreciated the approach of Dukovany NPP to the implementation of safety recommendations [6-7], [6-8].

<u>IPERS:</u>

The IPERS mission took place in 1998, focusing on first level PSA study, in order to assess the study and propose specific proposals for its improvement. 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.

<u>IPPAS:</u>

The IPPAS mission was organized in 1998 in order to evaluate 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 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.

<u>SALTO:</u>

In 2008, based on the invitation of the SÚJB, mission Peer Review was implemented. The mission was focused on Safe Long Term Operation (SALTO) that was to review the programs/activities of Dukovany NPP. 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 [6-9]. The subsequent mission in 2011 evaluated their solution. 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.

Another SALTO mission took place in 2014 in order to assess Dukovany NPP readiness for extended operation beyond the design life (see Annex 3).

WANO mission

WANO Peer Review:

A mission took place for the first time in 1997 in order to verify the systems and working procedures by INPO criteria. The following fields were verified: Organization and Control, Operation, Maintenance, Technical Support, Personnel Training, Chemistry, Radiation Protection, Emergency Planning, and Operational Experience Feedback. The mission positively evaluated Dukovany NPP and presented seven strong points in six fields.

Another Peer Review WANO mission took place in 2007. The following fields were verified: Organization and Control, Operation, Maintenance, Technical Support, Radiation Protection, Operational Experience Feedback, Chemistry, and Personnel Training and Qualification. Of these eight fields, the mission defined 7 Good practices, 3 Strong points and 12 proposals for improvement. [6-21]

Subsequent mission WANO Peer Review took place in 2009. Its purpose was to check the method and status of solutions to the proposals for improvement drafted in 2007. Three fields for improvement were evaluated as resolved, eight fields were classified with satisfactory progress and one field was evaluated as being settled with a small progress. [6-22]

Another mission WANO Peer Review took place in 2012 and was focused on the safe operation of power plant and special attention was given to SOERs (Significant Operating Experience Report), in particular to those recently issued in connection with the events occurred in Fukushima Daiichi NPP [6-23]. Foreign experts presented 19 areas for improvement as well as four good practices and five strengths. The subsequent mission took place in 2014 (see Annex 3).

Assessment by EU

WENRA:

In 2000 the Western European Nuclear Regulators Association performed an assessment of nuclear safety 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.

AQG:

In 2001, 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. 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 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 ("Bubble Condenser Experimental Qualification") projects results, 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.

ENSREG:

In 2011, so-called "Stress Tests" were carried out at Dukovany NPP 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[1] [6-24] and through the National Report of the Results of Stress Tests of Czech Nuclear Power Plants[2] [6-25] submitted to experts appointed by ENSREG for assessment.

As the second phase of independent safety assessment of NPP, the so-called "Country Review" was carried out at SÚJB in Prague and at Dukovany NPP between 26th and 29th March 2012.

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 events 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 (see Annex 9). This includes a number of corrective measures, some of which were proposed before the events that occurred at Fukushima NPP and the Stress Tests confirmed their appropriateness.

Other activities

Technical audit:

A technical audit, internal and external, was held at Dukovany NPP in 1993-1995.

The goal of the internal technical audit was to map the current status of the systems, structures and components of nuclear power plant units. The evaluation was made using two approaches – first level PSA study and a deterministic approach with the use of Final Safety Analysis Report, related studies and analysis. The internal audit was performed by the plant's specialists of the licensee. The resulting output was an overall evaluation of the all units, including proposal of modernization efforts relating to nuclear safety, reliability and operation economics.

The goal of the external technical audit was to evaluate independently the level of nuclear safety assurance at 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 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.

PSR:

[1] https://www.cez.cz/edee/content/file/pro-media-2012/02-unor/final-report-st-edu.pdf
[2] http://www.sujb.cz/fileadmin/sujb/docs/dokumenty/National_Report_Revision_1_for_web_1.pdf

SÚJB conditioned the obtainment of approval for operation of Dukovany NPP units by performing Periodic Safety Review (PSR) in the extent specified in the IAEA Safety Guide No. NS-G-2.10. The first review was performed in 2005 – 2006 resulting in requirements for specific measures to enhance the level of safety assurance. The second review started in 2013 and ended in 2014. Results of this review were used as one of the supporting documents for an application for a licence to operate the Dukovany NPP Unit 1 issued in March 2016 (after 30 years of operation). It will be similar for the Dukovany NPP Units 2, 3 and 4 in the future.

The nuclear installation operator utilizes other instruments (deterministic and probabilistic) to monitor continuously and to evaluate periodically the nuclear safety of nuclear installations. These instruments are described in Chapter 14.

6.3.2 Implemented and planned measures to improve the standard of nuclear safety

First implemented measures to enhance nuclear safety were executed within the "Back-fitting of Dukovany NPP" project. This project was created as a response to the first analyses after putting the units into operation and the first findings from the Chernobyl accident under Government Decree No. 309/1986.

The Czech Republic proceeded to this step as a number of other countries, despite the fact the Chernobyl reactor had entirely different physical and technical parameters than the pressurized water reactors installed at Dukovany NPP. The "Back-fitting of Dukovany NPP" project was completed in 1990; its implementation started in 1991 and was completed in 1996.

The assessment of equipment state and international activities in 1992-1997 (see Chapter 6.3.1) resulted in MORAVA "Equipment Renovation Program" elaborated as a set of requirements on modification of Dukovany NPP equipment, to ensure safe, reliable and economical operation.

A subgroup of activities with direct relation to fulfilment of SÚJB and IAEA requirements was selected from the MORAVA program. This subgroup is called Modernization Program and its most important project is the "I&C Renovation" – replacement of safety-important parts for digital systems, which was performed in parts during unit outages.

At Units 1 - 4, the renovation of Instrumentation and Control Systems of the parts important to safety is fully implemented. The renovation of the main equipment of Instrumentation and Control System using modern control facilities started on the Dukovany NPP Unit 3 in 2009 with completion in 2013; implementation on other units took place at the following intervals: Dukovany NPP Unit 1 – 2011 to 2015, Dukovany NPP Unit 2 – 2012 to 2015, Dukovany NPP Unit 4 – 2010 to 2014. Total list of important modifications is included in Annex 1 to the National Report of the Czech Republic of 2013.

The National Action Plan prepared on the basis of the LTO project and Stress Tests is a new stage of further enhancement of safety level. For its scope see Annex 9.

A single approach to the drawing-up of the Programs for Safety Enhancement has been accepted.

6.4 Temelín NPP

6.4.1 Overview of international nuclear safety assessments performed and their main conclusions

Assessment of the original design at Temelín NPP performed by Czech and Slovak specialists has been under way since the beginning of its construction. After 1989, the demand for construction of 4 Units was re-evaluated, and particularly, the level of nuclear safety assurance was assessed, taking into account experience from Western nuclear power plants. This assessment was carried out in the form of international missions aimed at independently assessing the original design and other aspects of the construction from the viewpoint of internationally recognized standards.

IAEA mission

<u>Site Safety Review, Design Review:</u>

A mission aimed at evaluating the site safety took place in April 1990 and the mission focused on evaluation of safety systems, core design and safety analyses was held at June and July 1990. Final reports from the missions [6-10], [6-12] included 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.

<u>OSART:</u>

The Pre-OSART mission took place at the turn of April and May 1990 and it focused on practice in power plant construction and on preparation for safe operation [6-11].

Another Pre-OSART mission was held in 1992. The mission assessed the extend of implementation of the recommendations of the previous mission. [6-13].

At the beginning of 2000, further mission Pre-OSART took place at Temelín NPP and full OSART mission took place in February 2001. Follow-up OSART mission took place in 2003 – see Annex 3 to "The Czech Republic National Report 2004". See Annex 3 to the National Report of the Czech Republic for 2004.

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. [6-26]. Five recommendations and six proposals for improvement as well as six good practices were formulated. The follow-up mission assessing the implementation progress of the recommendations and proposals took place in 2014. (see Annex 3).

<u>QARAT:</u>

The QARAT mission, held in 1994, aimed at verifying the quality assurance area. The group of experts confirmed distinct development in this area [6-14].

<u>LBB Application Review:</u> Missions on LBB analysis took place in 1993, 1994 and 1995 at Temelín NPP. 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.

<u>Safety Issues:</u> A mission evaluating Safety Issues identified by the IAEA for nuclear power plants with VVER-1000/320 reactors [6-17] was held in 1996. The mission 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 very highly appreciated ČEZ, a. s. that it had spent a significant effort to improve the Temelín NPP's design [6-18]. The mission emphasized that the combination of Eastern and Western technology in the Temelín NPP design was very carefully considered. 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.

A follow-up mission of the same type took place in 2001. The status of each safety issue for VVER 1000/320 units as specified by IAEA can be found in Annex 2.

IPERS, IPSART:

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. In 2003, the IPSART mission re-examined the previous verifications 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.

Fire Safety:

A mission focused on fire protection took place in 1996. It was stated that substantial improvements were made in compliance with international trends of fire protection [6-16].

IPPAS:

A mission was organized in 1998 and 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.

A Follow-up mission took place in 2002. The objective of the 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.

Preparedness and Commissioning Review Mission:

This mission took place in 2000. The objective 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.

Site Seismic Hazard Assessment:

A mission took place in 2003 and 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.

WANO mission

WANO Peer Review:

A mission took place for the first time in 2004 and the following fields were verified: Organization and Control, Operation, Maintenance, Technology, Radiation Protection, Operational 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 [6-19].

A Follow-up Peer Review WANO mission took place in 2006. Out of 13 proposals for improvement from the previous mission, six fields were assessed as completed in full and seven fields were assessed as fields with satisfactory improvement, but with uncompleted activities. At the same time, the mission submitted its proposals for further continuation in such fields [6-20].

The most recent mission WANO Peer Review took place at Temelín NPP in November 2011. The reviewed areas were for example: radiation protection, emergency planning and personnel preparedness. Experts appreciated the high professionalism of personnel and the achieved safety level of power plant. The mission WANO summarized its findings in the form of 17 proposals for improvement and 3 good practices for other NPP operators all over the world [6-27]. The subsequent mission in 2013 evaluated the rate of recommendation implementation (see Annex 3).

A WANO Peer Review took place at the Temelín NPP in 2015 according to the new Performance Objectives and Criteria (see Annex 3).

Assessment by EU

<u>WENRA:</u>

The assessment of nuclear safety in the EU candidate countries was carried out in 1998 and 2000. 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.

<u>AQG:</u>

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 in November 2002.

The high-energy pipe break protection is based on combination of extremely low probability of a sudden break of the pipeline under normal or abnormal operation conditions or in seismic event, application of French “super pipe” concept (that precludes sudden pipe break for the area from containment penetration to anchoring point), 100 % qualified ultrasonic inspections, corrosion-erosion monitoring program, etc. Whip restraints are installed in accordance with recognized Western standards. Computer programs used for assessment are validated in full.

Reliable function of important by-pass valves to atmosphere and safety valves for the case of occurrence of two-phase steam-water medium, i.e. qualification of respective valves, was demonstrated, in accordance with international standards, by creating new qualification set of knowledge. The principle is based on assignment of the valve under review to the group of valves of the same manufacturer and with comparable characteristics that were tested for full scope of required parameters.

<u>ENSREG:</u>

In 2011, the so-called “Stress Tests” were carried out at Temelín NPP according to the ENSREG specification – focused review of safety margins of NPPs in connection with the events that occurred at the Fukushima Daiichi 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[3] [6-28] and through the National Report of the Results of Stress Tests of Czech Nuclear Power Plants[4] [6-25] submitted to experts appointed by ENSREG for assessment.

As the second phase of independent safety assessment of NPP, the so-called "Follow-up fact finding visit ENSREG" was carried out at Temelín NPP between 10th and 12th September 2012.

Results of the focused review of safety margins and resistance of NPP, required by the European Council, confirm efficiency and appropriateness of before 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 even 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 (see Annex 9). This includes a number of corrective measures, some of which were proposed before the event at Fukushima NPP and the Stress Tests confirmed their appropriateness. Most of the proposed measures have already been implemented. A summary of the measures implemented in recent years, identified not only in the framework of the National Action Plan but also the PSR, is provided in Chapter 18.1.3.

Other activities

Examples of other activities linked to safety assessment and re-evaluation are as follows:

Consultants meeting on the Temelín NPP design changes held at the IAEA Headquarters in 1994 in Vienna [6-15].

Study conducted by the ENCONET Consulting company on compatibility of Eastern and Western technologies – "The Temelin NPP Compatibility Study", 1996.

Positive environmental impact assessment of Temelín NPP by Technical University in Vienna (Atominstitut) in August 2001.

PSR:

SÚJB conditioned the obtainment of licence for operation of Temelín NPP units by performing Periodic Safety Review (PSR) in the extent specified in the IAEA Safety Guide No. NS-G-2.10. The first review was performed in 2008 – 2010 resulting in requirements for specific measures to enhance the level of nuclear safety assurance. Results of this review served as one of the basis of an application for a licence for continue operation after 10 years of operation.

The licensee ČEZ, a. s. utilizes other instruments (deterministic and probabilistic) to monitor continuously and to evaluate periodically the nuclear safety of nuclear installations. These instruments are described in Chapter 14.1.2.

[3] https://www.cez.cz/edee/content/file/pro-media-2012/02-unor/final-report-st-ete.pdf

[4] https://www.sujb.cz/fileadmin/sujb/docs/dokumenty/National_Report_Revision_1_for_web_1.pdf

6.4.2. Main changes in the design and other measures for the enhancement of nuclear safety implemented as a result of the analyses

Based on assessments mentioned in Chapter 6.4.1, technical improvements were proposed, implementation of which assured attainment of Western NPP standards for Temelín NPP. Recommendations were implemented in the form of amendment to the Basic and Detail design. The following may be mentioned as supporting improvements:

- Replacement of the I&C system, including its new design,
- Replacement of the nuclear fuel, including a new core design,
- Replacement of the original radiation monitoring system, including its design,
- Replacement and supplementing of the diagnostic system,
- Replacement of original cables with fire-proof and non-propagating fire ones,
- Significant changes in the electric part.

Total list of important modifications is included in Annex 1.

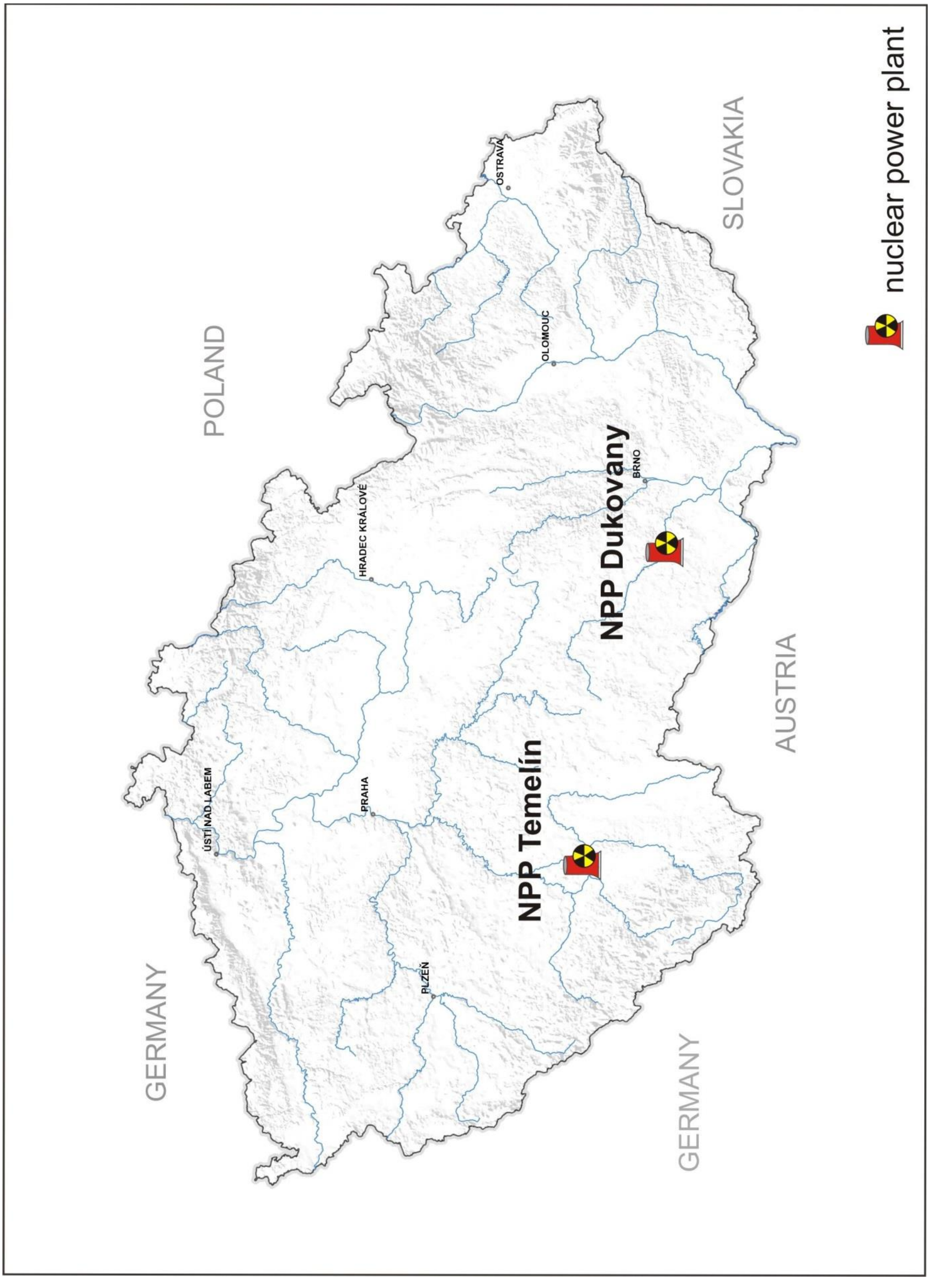
The National Action Plan drafted on the basis of the Stress Tests is a stage of further enhancement of safety level. For its scope see Annex 9.

A single approach to the drawing-up of the Programs for Safety Enhancement has been accepted.

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

All the above-mentioned studies and analysis 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. Establishing and maintaining a legislative and regulatory framework

7.1.1 Atomic Act

The Atomic Act – 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, was adopted by the Parliament of the Czech Republic in January 1997. The Atomic Act entrusted execution of the state administration and supervision of peaceful utilization of nuclear energy and radiation practices to SÚJB and redefined the scope of its competency and powers.

The Atomic Act has defined conditions for peaceful utilization of nuclear energy and ionizing radiation, including the activities requiring SÚJB licence. An extensive list of obligations of the licensees includes, among other items, obligations relating to their preparedness for a radiation accident.

In the area of radioactive waste management, the Act entrusted responsibility for final disposal of all radioactive wastes to the state and ordered to the Ministry of Industry and Trade of the Czech Republic to establish a new governmental organization for the purpose – the Radioactive Waste Repository Authority (SÚRAO). Pursuant to Act No. 219/2000 Coll., on the Property of the Czech Republic and Its Representation in Legal Relations, as amended, it is the governmental organization since 1 January 2001. Activities of the Radioactive Waste Repository Authority shall be funded from the so-called “nuclear account” whose main income is represented by payments from radioactive waste producers.

The Atomic Act transferred into the Czech legal system a number of 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.

Since 1997 the Atomic Act has been amended several times. The most significant amendment was performed by Act No. 13/2002 Coll., which was particularly adopted in connection with the preparation of the Czech Republic for accession to the European Union and the European Atomic Energy Community (Euratom), aimed at enabling the implementation of obligations arising from newly concluded international treaties. In connection with this Act, which became effective on July 1, 2002, the respective SÚJB Decrees were amended. The provisions related to radiation protection were amended in particular by reason of assuring the compatibility with the respective European directives. Another significant amendment was performed, for example, by Act No. 253/2005 Coll., in connection with adjustments in the field of technical safety. Last amendment of the Atomic Act was performed by Act No. 250/2014 Coll.

Other amendments were, among other things, affected by the adoption of Directive of the European Council No. 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations and creating a common harmonized framework in the area of nuclear safety after more than 50 years of existence of the Euratom. This directive refers to the Safety Fundamentals set out by the IAEA as a general framework for implementation of this directive.

Act No. 350/2012 Coll., amending the Atomic Act, imposed a fee obligation on the applicants for certain licences and on certain licensees for the professional activity performed by the State Office for Nuclear Safety. Such fees are paid by the applicant once in relation to the application submitted to issue certain licences or the licensee pays, on a regular basis (yearly), the so-called maintenance fees so that the licence is to remain in force.

Such administration fees represent a contribution to the payment of SÚJB costs associated with the issue of such licences and with the state supervision over activities carried out by such licensees. The fees in the proposed amount equal up to 60% of the envisaged budget of the expenditures of the SÚJB. However, in the case of issuing licences to construct a significant nuclear installation, this proportion can increase to more than 70%.

Preparation of the new Atomic Act and its implementing legal regulations

The new Atomic Act and its implementing regulations are currently being prepared. This preparation is not primarily driven by the need to set completely new legal relations, but rather to supplement and mainly to specify the existing legal regulations on the basis of experience obtained from twenty-year application of the Atomic Act (and related legislation) and with the use of the new recommendations of international institutions and other new knowledge, both process knowledge and expertise. The enabling provisions of the existing Atomic Act require a thorough adjustment to create the implementing legal regulations.

The new Atomic Act under preparation respects all changes presented both at international level and within the Euratom. In addition to individual IAEA recommendations, these are, for example, the amendment to Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations and its amendment by 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 new draft Atomic Act was handed over to the Chamber of Deputies of the Parliament of the Czech Republic by the Government of the Czech Republic in July 2015; the bill was debated on at the second reading and passed to the third (final) reading on 27 April 2016; the related act amending acts in connection with the adoption of the Atomic Act was similarly debated on. The implementing legal regulations being particularly prepared by the SÚJB are gradually finalised.

7.1.2 Related legislation

The basic legal standard governing the licensing process for nuclear installations includes, in addition to the above-mentioned Atomic Act and Act No. 183/2006 Coll., on Spatial Planning and Building Rules (the Building Act), as amended, effective as from January 1, 2007. Other most important legal regulations related to this area are in particular:

- Act No. 500/2004 Coll., Administrative Code, as amended;

- Act No. 634/2004 Coll., on Administrative Fees, as amended;
- Act No. 255/2012 Coll., on Inspection (Inspection Code), as amended;
- Act No. 100/2001 Coll., on Environmental Impact Assessment, as amended;
- Act No. 106/1999 Coll., on Free Access to Information, as amended;
- Act No. 123/1998 Coll., on the Right to Environmental Information, as amended;
- Act No. 239/2000 Coll., on Integrated Rescue System and on Amendment to Certain Related Acts, as amended;
- Act No. 240/2000 Coll., on Crisis Management and on Amendment to Certain Related Acts (Crisis Act), as amended;
- Act No. 22/1997 Coll., on Technical Requirements for Products on Amendment to Certain Related Acts;
- Act No. 373/2011 Coll., on Specific Medical Services, as amended;
- Act No. 505/1990 Coll., on Metrology, as amended;
- Act No. 412/2005 Coll., on Classified Information Protection and on Security Capacity, as amended.

7.1.3 Multilateral international treaties and treaties with IAEA

The following international treaties signed by the Czech Republic (or the former Czechoslovak Socialist Republic and later the Czech and Slovak Federal Republic) are parts of the valid Czech legislation in the given area:

- The Convention on the Physical Protection of Nuclear Materials (in Vienna on October 26, 1979, communication of Ministry of Foreign Affairs No. 27/2007 Coll.).
- The Convention on Early Notification of a Nuclear Accident (in Vienna on September 26, 1986, communication of Ministry of Foreign Affairs No. 116/1996 Coll.).
- The Convention on Assistance in the Case of a Nuclear or Radiation Accident (in Vienna on September 26, 1986, communication of Ministry of Foreign Affairs No. 115/1998 Coll.).
- Nuclear Safety Convention (in Vienna on June 17, 1994, communication of Ministry of Foreign Affairs No. 67/1998 Coll.).
- Vienna Convention on Civil Liability for Nuclear Damage (in Vienna on May 21, 1963, ratified, communication of Ministry of Foreign Affairs No. 133/1994 Coll., communication of Ministry of Foreign Affairs No. 125/2000 Coll.).
- The Joint Protocol relating to the Application of the Vienna and Paris Conventions on Liability for Nuclear Damage (in Vienna in 1988, ratified, communication of Ministry of Foreign Affairs No. 133/1994 Coll.).
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radiological Waste Management (in Vienna on September 30, 1997, Government resolution No. 593/1997, ratified on March 26, 1999).
- The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) (Decree by Ministry of Foreign Affairs No. 61/1974 Coll., of March 29, 1974).

- The 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).
- The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, February 25, 1991, ratified on February 26, 1991, communication of Ministry of Foreign Affairs No. 91/2001 Coll.).
- Convention on Access to Information, Public Participation in Decision–Making and Access to Justice in Environmental Matters (Aarhus, Denmark, 1998, ratified on October 4, 2004, communication of Ministry of Foreign Affairs No. 124/2004 Coll.).
- The Convention on Korean Energetics Development Organization (KEDO) – letter of Ministry of Foreign Affairs on acceptance of the Agreement of March 9, 1995 and of the supplemental Protocol of 1997 by the Czech Republic dated January 27, 1999; the Czech Republic became a member on February 9, 1999.
- 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 18, 1996, communication of Ministry of Foreign Affairs No. 68/1998 Coll.).
- The 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, communication of Ministry of Foreign Affairs 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, communication of Ministry of Foreign Affairs No. 509/1990 Coll.).
- International Labour Organization Convention (No. 115) Concerning the Protection of Workers Against Ionising Radiation (Geneva, June 22, 1960, communication of Ministry of Foreign Affairs No. 465/1990 Coll.).
- Comprehensive Nuclear Test Ban Treaty (has not yet entered into force, signed by the Czech Republic in November 12, 1996 and ratified in September 11, 1997.
- The Protocol on Amendment to the Vienna Convention on Civil Liability for Nuclear Damage (in Vienna on September 12, 1997, signed by the Czech Republic in June 18, 1998, however it has not been ratified yet). 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.
- The Protocol on Amendment to the Vienna Convention on Civil Liability for Nuclear Damage (in Vienna on September 12, 1997, signed by the Czech Republic in June 18, 1998, however it has not been ratified yet). 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.

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

7.1.4 Bilateral cooperation

The bilateral cooperation is concluded:

- With Slovakia (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 a regular basis and annual meetings are held.

- With 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 is in progress.
- 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 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).
- With the United States of America (Agreement between the Government of the Czech and Slovak Federal Republic and the Government of the United States of America on Cooperation in Peaceful Uses of Nuclear Energy), which takes place at formal and informal levels.

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

7.2 Other requirements and frameworks

7.2.1 National safety requirements and regulations

Implementing legal regulations

The Atomic Act authorized the SÚJB, and in strictly defined cases other bodies of the state administration, to issue a set of related implementing regulations, which are listed in detail in Annex 5, such as the following:

- ***SÚJB Decree No. 146/1997 Coll.,*** specifying activities directly affecting nuclear safety and activities especially important from radiation protection viewpoint, requirements on qualification and professional training, on method to be used for verification of special professional competency and for issue authorizations to selected personnel, and the form of documentation to be approved for the licensing of expert training of selected personnel, as amended by the SÚJB Decree No. 315/2002 Coll.,
- ***SÚJB Decree No. 215/1997 Coll.,*** on criteria for siting nuclear installations and very significant ionizing radiation sources,
- ***SÚJB Decree No. 106/1998 Coll.,*** on nuclear safety and radiation protection assurance during commissioning and operation of nuclear facilities,
- ***Government Order No. 11/1999 Coll***., on emergency planning zone,
- ***SÚJB Decree No. 195/1999 Coll.,*** on basic design criteria for nuclear installations with respect to nuclear safety, radiation protection and emergency preparedness,
- ***SÚJB Decree No. 307/2002 Coll.***, on radiation protection, as amended,

- ***SÚJB Decree No. 318/2002 Coll.,*** on details of emergency preparedness of nuclear installations and workplaces with ionizing radiation sources and on requirements on the content of on-site emergency plan and emergency rule, as amended by the SÚJB Decree No. 2/2004 Coll.,
- ***SÚJB Decree No. 319/2002 Coll.,*** on performance and management of the national radiation monitoring network, as amended by the SÚJB Decree No. 27/2006 Coll.,
- ***SÚJB Decree No. 185/2003 Coll.,*** on decommissioning of nuclear installation or workplaces of category III or IV,
- ***SÚJB Decree No. 309/2005 Coll***., on assurance of technical safety of selected equipment,
- ***SÚJB Decree No. 132/2008 Coll.,*** on Quality Assurance System in carrying out activities connected with utilization of nuclear energy and radiation protection and on Quality assurance of selected equipment in regard to their assignment to classes of nuclear safety.

A complete text of the Atomic Act and its implementing legal regulations is available at the SÚJB website[5].

7.2.2 System of licensing

The legal standard governing the approval process for nuclear installations includes, in addition to the above-mentioned Atomic Act and Act No. 183/2006 Coll., on Spatial Planning and Building Rules (the Building Act), as amended, effective as from January 1, 2007.

According to the Building Act, the issuance of key resolution for all installations with nuclear facilities, i.e. planning and siting decision, is entrusted to the Ministry of Regional Development. The Ministry of Industry and Trade is now entrusted with the issuance of other resolutions (construction permit, final inspection approval and decommissioning permit).

Provided the related procedure involves interests protected by special regulations, such as nuclear safety or radiation protection, the department of planning and building control shall decide in cooperation with or based on an approval from the respective state administration bodies protecting such interests. A respective state administration 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 safety of pressure components and electric systems,
- regional and municipal authorities in respect to fire safety, waste management, water consumption and effluents discharge,
- Czech Environmental Inspection – in respect to air pollution,
- Local body in charge of public health protection in respect to industrial safety in agreement with Act No. 258/2000 Coll., on public health protection, as amended.

Section 86(2) and Section 110(2) of the Building Act directly imposes liability upon the applicant and operator to present binding approaches or decisions of the authorities concerned to competent authorities according to special regulations, in this case of the Atomic Act.

The Atomic Act establishes activities for which a licence issued by the SÚJB is required. Apart from the main activities - siting, construction and operation, there are a number of other activities, e.g. the

[5] http://www.sujb.cz/en/

SÚJB licences for individual stages of nuclear installation commissioning, for reconstruction or other changes affecting nuclear safety, for discharge of radionuclides into the environment, etc. More detailed information is provided in Chapter 8.

Act No. 100/2001 Coll., on Environmental Impact Assessment, as amended, 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 relevant authority responsible for the issuance of an opinion concerning the environmental impact of the nuclear power plant.

The approval process legislative framework is defined by Act No. 183/2006 Coll., on Spatial Planning and Building Rules (the Building Act), as amended, the Atomic Act and their implementing decrees.

In the case of a nuclear installation construction, the Building Act No. 183/2006 Coll., establishes a three-stage procedure for its permitting (site decision, construction permit and final inspection approval). The Ministry of Regional Development exercises the competence of a building office to issue a site decision (siting) pursuant to Section 13(2) of Act No. 183/2006 Coll.

The construction permit and final inspection approval (continuous operation) – are issued by a special department of planning and building control of the Ministry of Industry and Trade. Their resolutions are conditional upon positions or decisions issued by specialized regulatory bodies, including the SÚJB.

The Atomic Act establishes the way of utilization of nuclear energy and ionizing radiation, as well as conditions for the performance of activities related to the utilization of nuclear energy and radiation practices. A precondition for the performance of such activities is a licence issued by the SÚJB with an administrative procedure, which is independent of the above-described procedure required under the Building Act. The Atomic Act explicitly forbids launching siting, construction, operation and other activities at nuclear installations, requiring the licence issued by the SÚJB, before the respective licence becomes legally effective.

That means that the approval procedure, besides the three-stage process mentioned above, also includes a number of other separate licences issued by the SÚJB in accordance with the Atomic Act during different stages of the life cycle of a nuclear installation, specifically the following is concerned:

Section 9, paragraph 1 of the Atomic Act establishes the following conditions for the utilization of nuclear energy and ionizing radiation:

(1) A license issued by the SÚJB is required for:

- *a) siting of a nuclear installation or radioactive waste repository;*
- *b) construction of a nuclear installation;*
- *c) particular stages, laid down in an implementing legal regulation, of nuclear installation commissioning;*
- *d) operation of a nuclear installation;*
- *e) restart of a nuclear reactor to criticality following a fuel reload;*
- *f) reconstruction or other changes affecting nuclear safety, radiation protection, physical protection and emergency preparedness of a nuclear installation or category III or IV workplace;*
- *g) particular stages of decommissioning of a nuclear installation or category III or IV workplace to the extent and in the manner established in an implementing legal regulation;*
- *h) discharge of radionuclides into the environment to the extent and in the manner established in an implementing legal regulation;*
- *i) ionizing radiation sources management to the extent and in the manner established in an*

implementing regulation;

- *j)* *radioactive waste management to the extent and in the manner established in an implementing legal regulation;*
- *k)* *import or export of nuclear items or transit of nuclear materials and selected items;*
- *l)* *nuclear materials management;*
- *m)* *transport of nuclear materials and radioactive substances laid down in an implementing legal regulation; this licence does not relate to the person performing the transport, or to the carrier, unless he is simultaneously the shipper, or consignor or consignee;*
- *n)* *professional training of selected personnel (Section 18 paragraph 5);*
- *o)* *re-import of radioactive waste originated in the processing of materials exported from the Czech Republic;*
- *p)* *international transport of radioactive wastes to the extent and in the manner established in an implementing regulation;*
- *q)* *performance of personal dosimetry and other services significant from the viewpoint of radiation protection to the extent and in the manner established in an implementing regulation;*
- *r)* *adding of radioactive substances into consumer products during their manufacturing or preparation or import or export of such products.*

Other provisions of the Atomic Act define:

- conditions to be fulfilled before a licence is issued (Section 10),
- probity and professional competence of the applicant for a licence (Sections 11 and 12),
- application for a licence (Section 13),
- SÚJB administrative procedure (Section 14),
- licence particulars (Section 15),
- alterations, cancellations and cessation of licence (Section 16).

No changes shall be made without a previous SÚJB approval on installations or other technical or organizational changes important from the viewpoint of assurance of nuclear safety, radiation protection, physical protection or emergency preparedness. Changes that affect 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 competences.

SÚJB may modify conditions set out in the licence in the event of a change in the circumstances impacting on nuclear safety, radiation protection, physical protection or emergency preparedness under which the licence is issued, or as a response to an application by the licensee. 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 competences.

System of SÚJB Safety Guides

In a broad sense, the legislative framework is closed by a number of recommendations and guides issued from 1978 by the State Supervisory Body for Nuclear Safety in a special non-periodic editorial series “Safety of Nuclear Installations – Requirements and Guides”.

A total of 55 documents (guidelines, translations of IAEA recommendations, etc.) were issued in this series of publications in 1994 – 2007. The follow-up stage was the preparation of new or amendment of older guidelines aimed at incorporating the requirements of WENRA reference levels, which was completed in 2010. This period of time is followed particularly by amendments to the existing SÚJB Safety Guides.

SÚJB Safety Guides are published on the SÚJB's website; they are prepared in consultation with the professional public, with the licensee being allowed to make its comments. After their issue, collected are any comments, which serve as one of the supporting documents for making decision on another revision or on issuing a new SÚJB Safety Guide.

7.2.3 System of regulatory inspection and assessment

Inspection activities to be performed by the SÚJB are defined in detail in Section 39 and subsequent sections of the Atomic Act, as well as in Act No. 255/2012 Coll., on Inspection (Inspection Code), as amended.

For detailed description of the above mentioned requirements and approval procedures see Chapters 14, 15, 16, 17, 18 and 19 of this National Report.

Inspection activities

State supervision of peaceful utilization of nuclear energy and ionizing radiation in the field of inspection activities, including penalty measures, is governed by Chapter 6 of the Atomic Act, which comprises:

- supervising activities of the SÚJB (Section 39),
- remedial measures (Section 40),
- penalties (Sections 41 and 42).

The general rules governing the procedure of administrative authorities in performing the inspection activities are regulated by Act No. 255/2012 Coll., on Inspection (Inspection Code). The two acts above provide the SÚJB with corresponding power and competence for execution of the state supervision. The SÚJB controls whether the bodies which obtained a licence in accordance with Section 9(1) or the bodies carrying out activities associated with nuclear energy utilization and radiation practices, which are not subject to authorization or notification, comply with the requirements laid down in the Atomic Act and other regulations issued on its basis.

Inspectors are the SÚJB inspectors, appointed by the SÚJB Chairperson. They work at the SÚJB Headquarters and directly at the sites of Dukovany NPP and Temelín NPP, as well as in the Regional Centres (see Chapter 8.1.4).

The inspectors and the SÚJB Chairperson are entitled to participate in investigations and conclusions of events with an impact on nuclear safety, radiation protection, physical protection and emergency preparedness, including unauthorised handling of nuclear items or ionising radiation sources.

In agreement 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,
- 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 is 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 to 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 inspectors shall be authorized, depending on the nature of the identified shortcoming, to:

- require the inspected person to remedy the situation within a set period of time,
- charge the inspected person to perform technical inspections, reviews or testing of function condition of the installation, its parts, systems or its assemblies, if necessary for verification of nuclear safety, radiation protection, and further to monitor and implement remedial actions for reducing or mitigation of lasting exposures,
- withdraw the special professional competence authorisation issued to an employee of the inspected person, in the event of a serious violation of his obligations or his not fulfilling requirements of professional competence and physical and mental capability.

7.2.4 Enforcement of applicable regulations and terms of licences

Instruments applied to enforce the legislative requirements are regulated by Sections 40 and 41 of the Atomic Act. The SÚJB is authorized to require the inspected person to remedy the situation, to perform technical checks, inspections or functional ability tests and to impose penalties for violating obligations established in the Atomic Act.

In case there is a risk of delay, the SÚJB is authorized to impose the obligation to reduce the power output or to suspend operation of the nuclear installation. Issues of alteration, cancellation and cessation of a licence are regulated by Section 16 of the Atomic Act, which authorizes the SÚJB to restrict or to suspend performance of the licensed activity if the licensee has failed to fulfil the obligations thereunder.

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 Body

(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, an provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

(ii) Each Contracting Party shall take the appropriate steps to ensure an 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 foundations and statute of the regulatory body

The SÚJB was established through Act No. 21/1993 Coll., passed by the Czech National Council 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 ČSKAE (Czechoslovak Commission for Atomic Energy) in respect to the state administration and supervision of nuclear safety and nuclear materials. In July 1995 the Czech Republic's Parliament extended the SÚJB competence to supervision of ionizing radiation protection. As a result Czech Regulatory bodies for nuclear safety and radiation protection have merged and the SÚJB has become an integrated state administration body which carries out the state administration and supervision for the whole area of the peaceful utilization of nuclear energy and ionizing radiation. Since July 1, 1997 the competence of the SÚJB has been defined by the Atomic Act.

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

In 2005, the activity of the SÚJB has been extended pursuant to amendment of the Atomic Act by including the competence of the supervision of technical safety of special-designed classified systems, structures and components for nuclear installation (see letter w) and x) below). Special-designed systems, structures and components for nuclear installations may be used based on the assessment by legal person appointed for this purpose by procedure according to special legal regulation (i.e. authorized person within the meaning of Act No. 22/1997 Coll., on Technical Requirements for Products on Amendment to Certain Related Acts, as amended).

Due to the changes in Czech legislation, in particular legal effect of new Act No. 255/2012 Coll., on Inspection (Inspection Code), a part of the Atomic Act relating to the SÚJB's inspection activities was amended in 2014.

8.1.2 Mandate, mission and tasks

In accordance with the provisions of the Atomic Act, the SÚJB:

a) *shall carry out State supervision of nuclear safety, nuclear items, physical protection, radiation protection, emergency preparedness and technical safety of selected equipment and shall inspect the adherence to the fulfilment of the obligations arising out of this Act;*
b) *shall monitor non-proliferation of nuclear weapons and carry out state supervision of nuclear items and physical protection of nuclear materials and nuclear installations;*
c) *shall issue licences to perform practices governed by this Act and shall issue type-approvals for packaging assemblies for transport and storage of nuclear materials and radioactive substances*

given in an implementing legal regulation, ionizing radiation sources and other products;

d) shall issue authorizations for activities performed by selected personnel;

e) shall approve documentation, programs, lists, limits, conditions, methods of physical protection assurance, emergency rules and, subject to discussion with the relevant Regional Authorities and relevant Municipal Authorities of Municipalities with extended competence of compatibility with off-site emergency plans, on-site emergency plans and their modifications;

f) shall establish conditions, requirements, limits, maximum permitted levels, maximum permitted levels of radioactive contamination of foodstuffs, guidance levels, dose constraint, reference levels, diagnostic reference levels, exemption levels and clearance levels;

g) shall establish the emergency planning zone and, if applicable, its further structuring, and shall approve delineation of the controlled area;

h) in accordance with an implementing legal regulation, shall establish requirements on emergency preparedness of licensees, and shall inspect their fulfilment;

i) shall monitor and assess the exposure status and regulate exposure of individuals;

j) shall issue, register and verify personal radiation passport; related details shall be set out in an implementing legal regulation;

k) shall provide information to municipalities and Regional Authorities concerning radioactive waste management within their territory of administration;

l) shall control the activity of the National Radiation Monitoring Network, the functions and organization of which shall be set out in an implementing legal regulation, shall provide for the functioning of its head-office, and shall provide for the activities of an Emergency Response Centre and for an international exchange of information on the radiation situation;

m) shall establish State and Professional examination commissions for verification of special professional competence of selected personnel, and shall issue statutes for these commissions and specify activities directly affecting nuclear safety and activities especially important from the radiation protection viewpoint;

n) shall maintain a State system of accounting for and control of nuclear materials and data and information in accordance with international agreements binding on the Czech Republic, and shall set out requirements for accounting methods and inspection thereof in an implementing legal regulation;

o) shall maintain a national system for registration of licensees, registrants, imported and exported selected items, ionizing radiation sources, and a record of exposure of individuals;

p) shall ensure, by means of the National Radiation Monitoring Network and based on assessment of a radiation situation, the availability of background information necessary to take decisions aimed at reducing or averting exposure in the case of a radiation accident;

q) shall approve a classification of nuclear installation or its components and nuclear materials into appropriate categories, from the physical protection viewpoint;

r) shall perform the function of the national authority for an international verification of a comprehensive ban of nuclear tests;

s) shall ensure international co-operation within its sphere of competence and, in particular, shall be an intermediary of technical co-operation with the International Atomic Energy Agency, and within its sphere of competence shall communicate information to the European Commission or, if applicable, to other bodies of the European Union;

t) shall decide on assurance of handling nuclear items, ionizing radiation sources or radioactive wastes have been treated inconsistently with rules of law, or where the detrimental condition is not being removed;

u) shall be obliged to give out information according to special legal provisions and once a year to publish a report on its activities and submit it to the Government and to the public;

v) shall establish technical requirements to assure technical safety of selected systems, structures and components;

w) upon agreement with the administration office, shall inspect the activity of the authorized persons;

x) shall exercise the opinion on development policy and planning documents from the viewpoint of safety and radiation protection in activities related to nuclear energy utilization and in radiation practices.

8.1.3 Authorities and responsibilities

The powers of the SÚJB are the issuing of the decision on license or approval, receipt of the reports, keeping of the records, performance of inspection activities and making of the legislative regulations governing the conditions for peaceful utilization of nuclear energy and ionizing radiation. 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 47 of the Atomic Act, fully competent to issue decrees to implement particular provisions of the Act. The SÚJB is the guarantor of the safe utilization of nuclear energy and ionizing radiation in the Czech Republic. The SÚJB Chairperson decides on the appeal against the SÚJB's decision.

Administrative activities

In the matter of issuing a decision on licence, Section 9(1) of the Atomic Act lays down requirements, which are referred to in Chapter 7.2.2 hereof.

No technical or organizational changes to nuclear installation that are important from the viewpoint of assurance of nuclear safety, radiation protection, physical protection or emergency preparedness shall be made without a previous SÚJB permit. Changes that affect 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 competences.

SÚJB may modify conditions set out in the licence in the event of a change in the circumstances important to nuclear safety, radiation protection, physical protection or emergency preparedness under which the licence is issued, or as a response to an application by the licensee. 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 competences. Other requirements laid down by the Atomic Act are presented in Chapter 7.2.2.

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

- Quality Assurance Programs for the activities to be licensed,
- List of classified equipment,
- Method for providing physical protection,
- On-site emergency plan of nuclear installation,
- Programs for stages of nuclear installation commissioning,
- Limits and conditions for safe operation of the nuclear installation,
- In-service inspections program,
- Proposed decommissioning method,
- Monitoring program,

- Proposal of controlled area delineation,
- Limits and conditions for radioactive waste management during decommissioning process of a nuclear installation,
- Scope and method of measurement and evaluation of exposure of exposed workers and contamination of the workplace and its vicinity by radionuclides and ionising radiation, for decommissioning of a nuclear installation,
- Emergency plan of nuclear materials and radioactive substances transport,
- Proposal for classification of transported nuclear materials into relevant categories from the physical protection aspect,
- Method for providing physical protection of transport,
- Documents establishing the method of expert training of selected personnel,
- Changes of approved documentation.

Pursuant to Section 23 of the Atomic Act, the SÚJB issues a decision on type approval of packaging assemblies for transport, storage or disposal of nuclear materials and radioactive substances as well as a decision on type approval of ionizing radiation sources or radioactive substances of special form. On the basis of the successful exams in front of the state examining board, established by the SÚJB, an authorization is issued for activities carried out by selected personnel.

The SÚJB also administrates fees for SÚJB's professional activity that shall be paid by an applicant for a licence for siting, construction, operation and particular stages of decommissioning of a nuclear installation (fee and application) and a holder of the licence for operation or decommissioning a nuclear installation (maintenance fee). Exempted from these payments are public universities and those, whose activity is financed from public funds for science and research including EU funds.

If the licensee violates its obligations stipulated by the Act or by other regulations or the conditions provided by the SÚJB licence then SÚJB may restrict or suspend performance of the licensed activities.

The SÚJB shall cancel the licence if license holder ceases to fulfil the conditions decisive for its granting or if the licensee does not fulfil his duties stipulated by the Atomic Act or if he does not eliminate the deficiency detected by the SÚJB by the deadlines determined by the SÚJB.

Violation of a legal obligation established in the Atomic Act may be fined by the SÚJB with a penalization up to the amount specified in Section 41 and in agreement with the rules specified in Section 42 of the Atomic Act. The binding procedures for regulatory activities are set forth in the SÚJB internal regulations.

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.

8.1.4 Organizational structure of the regulatory body

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

- Section of Nuclear Safety including Nuclear Safety Assessment Department with Units of Mechanical Components and Quality management assessment , I&C and Electrical Systems assessment, Reactor Physics and Safety Analyses and Coordination of Assessment; Nuclear Installation Inspection Department with Units of Inspection of Systems, Inspection of Operation and Feedback and Inspectors at both nuclear power plants sites (Dukovany NPP and Temelín NPP) and a autonomous Spent Fuel and Radioactive Waste Management Unit,

- Section of Radiation Protection including Exposure Regulation Department with Natural Sources Unit, the Regional Centre in Hradec Králové and Registration and Assessment of Irradiation Unit, Radioactive Sources Department with the Regional Centres in Prague, Plzeň, Ústí nad Labem and Ostrava, Radiation Protection of Fuel Cycle Department with the Regional Centres in Kamenná, České Budějovice and Brno,
- Section of Management and Technical Support with International Cooperation, Strategy and Legal Units; Economic Department with Budgetary and Accounting Units; Office Bureau with State Service Affairs and Tendering Process Units and Non-Proliferation Department with Nuclear Non-Proliferation and Biological and Chemical Weapons Prohibition Units,
- Emergency Response and Informatics Department with IT and Emergency Response Centre Units,
- Internal Audit and Financial Control,
- Director for Security Affairs.

8.1.5 Development and maintenance of human resources over the past three years

For 2016, the SÚJB has established 214 posts attributed, of which 187 are service posts pursuant to Act No. 234/2014 Coll., on Civil Service, as amended. Compared to 2013, total number of employees increased by 5.4%, %, the majority of them providing professional activity of the SÚJB.

Of a 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 number of graduate employees to total number of employees. The SÚJB's staffing is stabilized from July 2015 in compliance with the requirement laid down in the Act on Civil Service. The number of jobs is approved by the Government of the Czech Republic and it may be changed only with its consent. The SÚJB Chairperson approves the organizational structure.

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

Inspectors shall have university master´s degree, predominantly with technical specialization. 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.

8.1.6 Measures to develop and maintain competence

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

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

As part of 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 resident inspectors of NPPs completed training on full-scope simulator of the control system of the nuclear power plant under supervision and improved thus significantly their qualification for their inspection activities. The inspectors participate also in SÚJB internal seminars organized to every significant event or event of interest from the viewpoint of SÚJB sphere of action. The seminars are especially focused on event description and cause analysis.

The SÚJB uses educational offers organized by various training entities such as the Institute for Public Administration 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 SW applications.

8.1.7 Developments with respect to financial resources over the past three years

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 2016 amounts to approximately CZK 360 million (approximately EUR 13.4 million).

On the basis of the approved systematization of the SÚJB, the salary conditions are set out for systematized posts. The amount of salaries is regulated by Government Order No. 564/2006 Coll., on emoluments of public service and administration employees, for employees, and Government Order No. 304/2014 Coll., on emoluments of public employees, for public employees, when the SÚJB is classified in the category of public employees with the highest demands as to the expertise.

The resources to finance the SÚJB by the national budget of the Czech Republic include fees for expert activities carried out by the SÚJB. 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 150 million. The rate of maintenance fee, which shall be paid by a holder of the licence to operate or decommission a nuclear installation, amounts to CZK 4 million per calendar month.

8.1.8 Statement of adequacy of resources

In the current conditions of the Czech Republic, material and human resources are sufficient for fulfilment of the basic functions imposed by the Atomic Act.

8.1.9 Management system of the regulatory body

The priorities of SÚJB are set out in order 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 ionizing radiation and in the non-proliferation of weapons of mass destruction. The priorities are based on 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 the activities carried out by the SÚJB and sets the control rules of management binding upon all of its employees. The management system of the SÚJB, as the central state administration body, is built upon the principles and requirements laid down by legislation of the Czech Republic and European legislation, international conventions and agreements in the field of SÚJB competence. The Standards and Recommendations of IAEA, WENRA, OECD – NEA, ICRP and other international institutions are also in use.

The documentation for integrated management system is produced in a way from general to more specific, taking account of 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 developing internal organizational regulations of the SÚJB and a mandatory procedure for the process of creating, revising and signing 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,

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

Level A concepts are: 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 Personnel Training, Education and Evaluation System; Order Establishing the State Examination Commissions for Verification of Special Professional Competence and Statutes for these Commissions; Rules for Budgetary Management in 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 management staff, establishment of the teams responsible for 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 Office website, drafting of the reports on 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 other SÚJB executive staff to cover the activities in the competence of SÚJB's divisions managed by them.

The important methodological instructions related to the activities carried out by SÚJB inspectors include the inspection procedures for the inspection of the state of selected systems of nuclear power plants, changes and modifications to projects of nuclear installations, 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 licensees' safety-related documentation, using the PSA, assessment the level of licensee's safety culture or assessment the safety performance indicators.

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

8.1.10 Openness and transparency communication with the public

The SÚJB website was created to facilitate gathering information concerning the performance of state supervision in the field of utilization of nuclear energy and ionizing radiation, and non-proliferation of nuclear weapons. The website was created with respect to the accessibility and free access so as to particularly meet the rules of WCAG 1.0 and Blind Friendly Web methodologies.

In accordance with the information policy of the state administration, the most relevant information is subject to the 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 published 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 accident at a nuclear installation or any other accident involving release of radioactive substances.

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

The SÚJB, just as the other central state administration 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 SÚJB is obliged to publish in accordance with the aforementioned Act, was included in the Annual Report on 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 so-called “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 occurred at NPPs. The SÚJB has also its Facebook page to publish brief information and curiosities, for example, from the field of nuclear industry, ionizing radiation utilization, nuclear safety and radiation protection for the general public.

8.1.11 External technical 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, v. v. i.) and also the National Radiation Protection Institute (SÚRO, v. v. i.). Those public research institutes were formed by transforming from the original organizational bodies of the state. SÚJCHBO, v. v. i., provides primarily professional and technical support to SÚJB in the field of chemical and radiation safety. SÚRO, v. v. i., provides professional and technical support in the field of radiation protection. In 2016, the planned volume of financial contributions to these two institutes amounts approximately to CZK 86 million (EUR 2.3 million).

The SÚJB also cooperates with many other organizations such as research institutes (e.g. Research Centre Řež), departmental organizations 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, building 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 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, Director for Radiation Protection, Director for Management and Technical Support, 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 particular departments, the Director of the National Radiation Protection Institute and the Director of the National Institute for Nuclear, Chemical and Biological Protection as necessary, shall be invited to management meetings.

In order 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. Meeting of this Commission shall be convened in the event of making decisions on appeal against decisions made by the SÚJB.

8.2 Status of the regulatory body

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

The statute of the SÚJB within the administration structure of the Czech Republic is shown in Fig. 8-2. 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.

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 utilization of nuclear energy and ionizing radiation directly to the Prime Minister, who plays the role of the representative of SÚJB in the negotiations of the government. Filling of management positions in the SÚJB takes place following a selection process pursuant to Act No. 234/2014 Coll., on Civil Service.

8.2.2 Reporting obligations

In compliance with the requirement laid down in the Atomic Act, the SÚJB submits annual reports on results of its activities to the Government of the Czech Republic. The annual report summarizes information on operation of nuclear installations, results of evaluation and inspection activities in all areas under supervision, information on financial matters, legislative activities, international cooperation and public communication. Special part of the report is devoted to the information on radiation situation in the Czech Republic and 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 the consultation with the Government of the Czech Republic and then published on the SÚJB website.[6] (Annual Reports of the State Office for Nuclear Safety are issued only in Czech language)

8.2.3 Means by which effective separation is between the functions of the SÚJB and other bodies or organizations is assured

The independence of SÚJB of other bodies or organizations results from the provisions of Section 3 of the Atomic Act: "*State administration and supervision of the utilization of nuclear energy and ionizing radiation and in the field of radiation protection shall be performed by the State Office for Nuclear Safety", and further from* Section 14: "*In administrative proceedings, the SÚJB hall conduct independently of the proceedings of any other administrative body. The applicant shall be the only participant in the proceedings*".

In agreement with Section 39 of the Atomic Act, an inspector or an inspection team to exercise control over compliance with the Atomic Act shall be only appointed from among SÚJB inspectors and the decision to invite other experts to participate in inspection falls fully under the remit of the SÚJB.

It is obvious from the above-listed legislative documents and the state administration structure in the Czech Republic, that 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.

8.2.4 Review of SÚJB activities taken by international missions

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

[6] http://www.sujb.cz/dokumenty-a-publikace/vyrocni-zpravy/vyrocni-zpravy-sujb/

in January 2000 and in June 2001. IRRS mission took place in November 2013.

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

- there exist a clearly defined legislative 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 in respect to 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 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 in respect to licensing, supervision, assessment and inspecting of Temelín NPP.

Members of the reviewing team stated several recommendations to the SÚJB whose implementation might further strengthen 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 peaceful utilization of nuclear energy and ionizing radiation. Twelve experts from nine countries carried out a review 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 transports of radioactive materials.

According to the results presented by the experts in a final report from the mission, the experts concluded that both the legislative framework and execution of the state supervision of peaceful utilization of nuclear energy and ionizing radiation were at a very good standard, corresponding to worldwide accepted practices. In respect to 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 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.

The IRRS mission in 2013 performed again a review of the regulatory framework of the Czech Republic of state supervisory activities in peaceful utilization of nuclear energy and ionizing radiation by comparing to the standards issued by IAEA and generally accepted international criteria. Moreover, the mission was used for information exchange between 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, legislative system – issuing of licences, documentation approval and inspection activity, safety assessment, emergency preparedness including response to radiological emergency, protection of the population and the environment from ionizing radiation, regulation of the doses of ionizing 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 SÚJB strategy, policy and transparency have been discussed during the mission.

In particular, the set of the measures adopted to strengthen the safety of nuclear power plants in the Czech Republic on the basis of in-depth review following the accident at the Fukushima Daiichi NPP have been thoroughly examined by the members of mission. The National Action Plan for the strengthening of 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 legislative 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 SÚJB as effective and independent regulatory body, respectively. The international experts concluded that the SÚJB employs technically qualified and well - motivated staff. In a number of the areas, the experts of the team appreciated the activities carried out by the SÚJB as good international practice, which they recommend to other states. They also presented some recommendations, which should contribute to strengthening and improving efficiency of the system of regulation of peaceful utilization of nuclear energy in the Czech Republic. Immediately after the evaluation of mission results, 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.

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

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

Fig. 8-1 Organizational Chart of the SÚJB

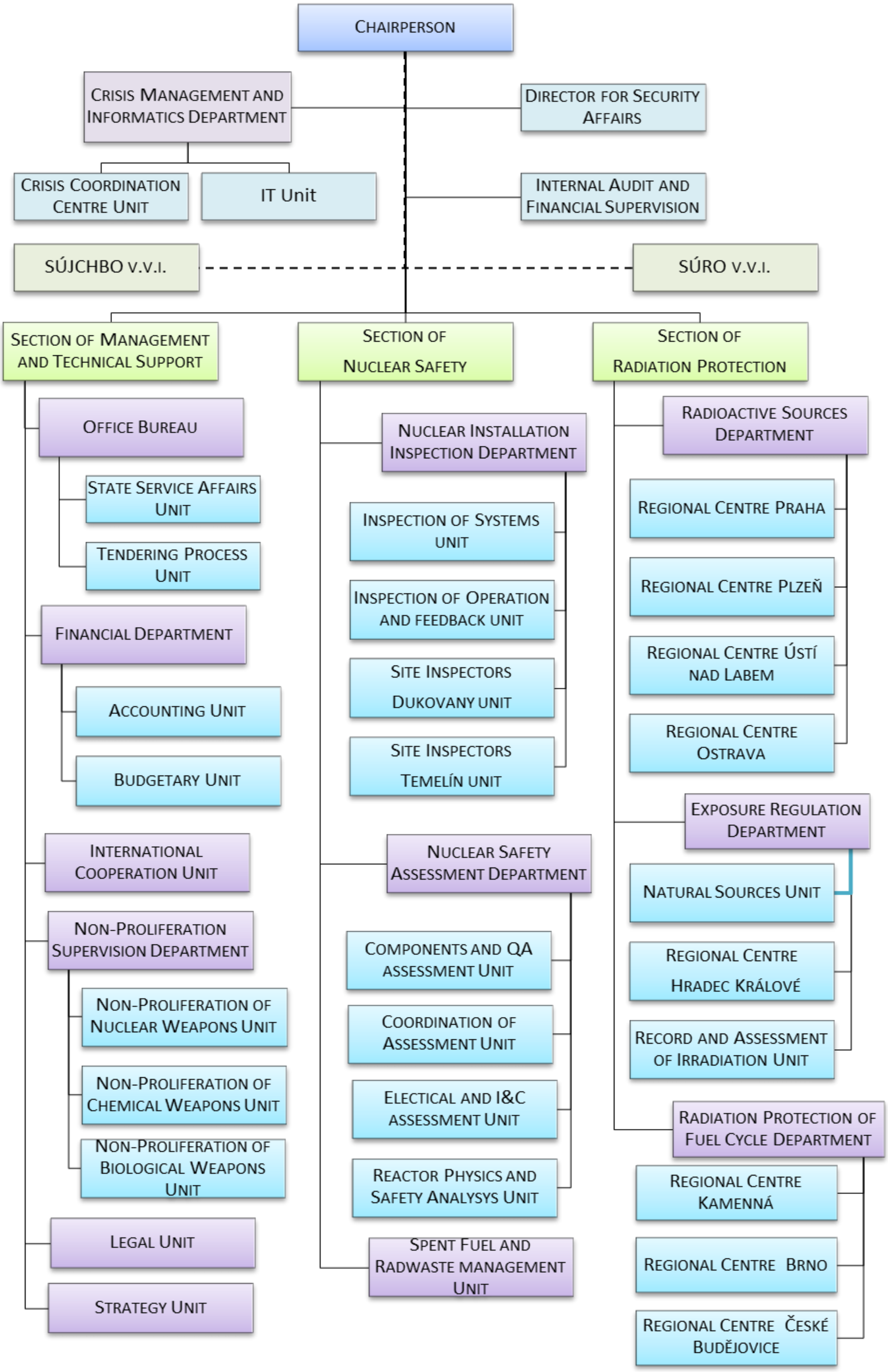
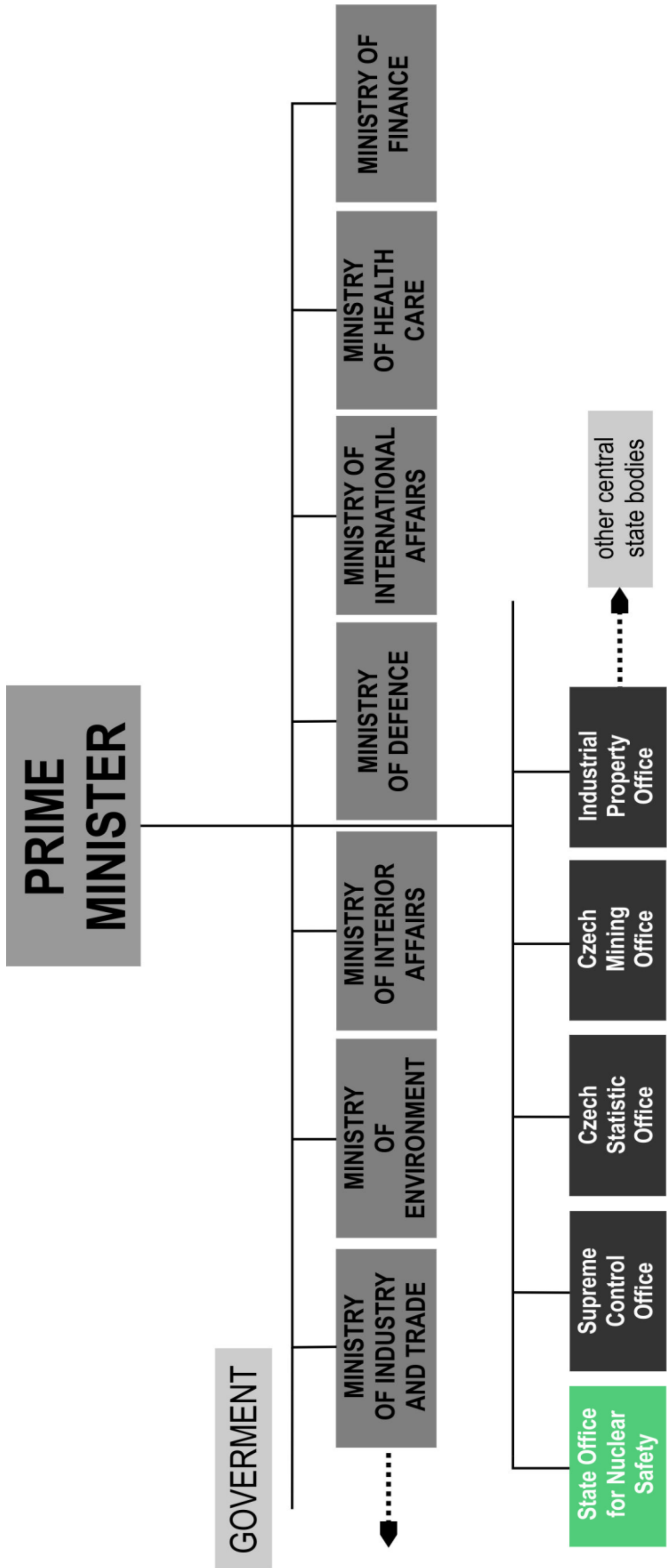


Fig. 8-2 Statute of the SÚJB within the State Administration



9. Responsibilities of the Licensee

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

In accordance with the current legislation of the Czech Republic represented particularly by the Atomic Act, the principle of responsibility of a licensee for nuclear safety of a nuclear installation has been broken down into a number of partial responsibilities, which together represent the over-all responsibility of a licensee for nuclear safety.

These partial responsibilities are specified particularly in Section 17 and Section 18 of the Atomic Act. The basic obligation of the licensee to provide for nuclear safety (while responsibility for nuclear safety cannot be transferred to any other person), radiation protection, physical protection and emergency preparedness of its nuclear installation, as defined in Section 17(1) a). The obligation to provide technical safety is imposed on the licensee by the provisions of Section 17(1) m). Other provisions subsequently define necessary obligations in respect to the nuclear safety assurance, e.g.:

- systematically assess and maintain nuclear safety and radiation protection, applying the most advanced tools of science and technology,
- comply with technical and organizational conditions of safe operation, with the conditions of the licence and approved quality assurance programs,
- investigate, without any delay, any violation of those conditions and take remedial measures and measures preventing repeated occurrence of such situations,
- report, without any delay, about events important for nuclear safety.

One of the main tasks of the state supervision of nuclear safety is monitoring of fulfilment of and adherence to the above-mentioned requirements. The rights of inspectors of nuclear safety and inspectors of radiation protection are defined, as mentioned above, in Section 39 of the Atomic Act and Act No. 255/2012 Coll., on Inspection (Inspection Code). In agreement therewith, the inspectors check on compliance with the requirements for and conditions of nuclear safety, radiation protection, physical protection, emergency preparedness and technical safety and inspect the nuclear installation conditions, adherence to the Limits and Conditions and operating procedures and demand evidence of fulfilment of all established obligations.

A holder of the licence to operate Dukovany NPP and Temelín NPP is the ČEZ, a. s., which has, as a licensee, the primary responsibility for 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 Quality Assurance 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, physical protection, emergency preparedness and technical safety, the events importance for nuclear safety are 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, physical protection and emergency preparedness 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 on a regular basis.

To assure continuous supervision and complex awareness of the state supervision of nuclear power plants, and to perform the de facto continual inspection activities, safety personnel of the SÚJB are present at both Dukovany NPP and Temelín NPP – the so-called “site inspectors”.

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

Another important obligation of the licensee mentioned in the Atomic Act is their liability for nuclear damage caused by operation of their nuclear installations (Section 33 of the Atomic Act).

The issues of licensee's responsibility for emergency preparedness or sufficient resources (technical, human, financial) to mitigate effects of an accident at a nuclear installation are addressed in Chapter 16.

9.2 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 mutual confidence and honesty, and the public has thus the opportunity to make sure of fulfilment of safety priority during operation of nuclear power plants in the Czech Republic.

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 plants premises, including both spent nuclear fuel interim storage facilities, their questions and comments have been answered.

Important tools in this effort are as follows:

- An Information Centre of the plant visited by nearly 30,000 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, made up of qualified and trained mayors, representatives and citizens, and representatives of local associations of municipalities. Since its establishment in 1996, the Civil Safety Commission is authorized to independently inspect the nuclear power plant and inform the public, has its own website[7]. The chairmanship of the commission was taken over by Aleš John, long-term member of WANO, from Bořivoj Župa in

[7] www.obkjedu.cz

2013. 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 nuclear area and discuss the current situation at Dukovany NPP and in nuclear area. The members of OBK as well as representatives of other organizations in the region receive experience from operating nuclear power plants through tours to nuclear installations in the Czech Republic and in Europe. Those representatives shall also receive information on Dukovany NPP operation by e-mail on each working day. Representatives (mayors) of all municipalities within the 20 km protection zone of NPP receive news on the situation at the Dukovany NPP and a summary of reports once a week and once a month, respectively.

- Several years ago, good practice of the Civil Safety Commission inspired Slovakia to establish OIK (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 with each other.
- The Energoregion 2020, which organizes 130 municipalities from the 20 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 Mayor of one of the municipalities – Rešice.
- Mayors of the Rouchovany and Dukovany municipalities resumed their activities in the GMF ("Group of European Municipalities with Nuclear Facilities" – European Association organizing municipalities and towns where the nuclear installation is located)[8].
- The initiative "Nuclear Regions of the Czech Republic" together with other regional societies protect 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.
- There is a website[9] available to the public. The following domains work on social networks: "ČEZ Lidem", "Kde jinde", "Pro jádro", "Třetí pól" 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 to every household within 20 km from the power plant. This Dukovany NPP publication has its own electronic and web-based version[10].
- Open communication with representatives of media. Meetings with journalists and press conferences concerning important topics and visits are held. Journalists are allowed to specific surveys and reporting directly from power plant operation.
- 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.
- The immediate foreign-country-oriented cooperation with crisis units of the country of Lower Austria neighbouring to the region of Dukovany NPP is reduced, but it is possible to follow up the past activities at any time.

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[8] www.gmfeurope.org
[9] https://www.cez.cz/en/home.html
[10] www.zpravodajedu.cz

Reliable operation of Dukovany NPP and the above mentioned activities bring the expected result. Support of the development of nuclear energy in the Czech Republic was 72 % after the accident in Japan and increased to 74 %. The total of 86% of the population within 20 km from Dukovany NPP wants modernization and long-term operation of Dukovany NPP and 70% wants its development.

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 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 power plant and ČEZ, a. s. company management. At the meetings, the mayors acquire information on operation of units, 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 of 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 in a similar way.

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.

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 preparation of “tailor-made” programs for individual groups of visitors. The Information Centre is visited by more than 30,000 people each year, with approximately 6 % 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. The Temelín NPP is one of the most open nuclear installations, when over 7,000 expert groups from the Czech Republic as well as abroad pass directly through the guarded area.

Through the activities carried out by the Information Centre of the Temelín NPP, the ČEZ Group 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 science 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.

The Prime Ministers of the Czech Republic and Austria concluded a completely super-general agreement on the exchange of information between both states in the matter of the Temelín NPP operation in December 2000 in Melk. A number of expert negotiations took place on the basis of this agreement and Temelín NPP also sends daily reports on its operation to the Austrian party, which are presented in Czech, English and German language also on the ČEZ, a. s. website.

The representatives of media receive daily information about operation; also meetings with journalists and press conferences concerning important topics 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, in particular 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 20 years already in an edition of 23 thousand copies and is, four 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 of the same name and communicates the activities through own 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 and distributed once in two years to the population in the surroundings of power plant.

Thanks to all of these activities, current (11/2015) support to the construction of a new nuclear unit in the region is at the level of 60%, while 70% of inhabitants questioned want further operation of the existing units.

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 Situation at the regulatory body

10.1.1 Supervision of the measures establishing safety priority

The SÚJB is responsible for state administration and supervision of the utilization of nuclear energy and ionizing radiation and in the field of radiation protection and other fields defined by the legislation in force. The authority and responsibilities of the SÚJB, as stipulated by Act No. 18/1997 Coll., on Peaceful Utilisation of Nuclear Energy and Ionising Radiation (Atomic Act), include the following issues in particular: State supervision of nuclear safety, nuclear items, physical protection of nuclear installations, radiation protection, and emergency preparedness of nuclear installations. It is carried out both by continuous monitoring of the operation of nuclear installations and by laying down rules for the reporting of events (types of reported events, time limit for the reporting of events) at nuclear installations by a licensee to the SÚJB and through inspection activities, by carrying out scheduled inspections and non-scheduled “ad hoc” inspections upon 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 SÚJB specialists.
- Events with unclear findings of the investigation by licensee, in particular in the field of breach of the Limits and Conditions.
- Events, which prove safety-relevant on the basis of their evaluation using the PSA.

Information on SÚJB competence is included in Chapter 8.

10.1.2 Measures taken by the regulatory body to ensure safety priority during its activities

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 requirement laid down in the IAEA Safety Standards Series No. GS-R-3 into the control documentation of the SÚJB (Organizational Standards), in particular:

- VDK 001 - SÚJB RULES OF ORGANISATION,
- VDK 099 - Integrated Management System Policy,
- VDK 100 - Integrated Management System Manual.

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

This Integrated Management System is structured and the Safety Structure forms one of its parts, which is composed of the following layers:

- 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.

The quality policy of SÚJB explicitly provides that the fundamental principles of safety culture 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 SÚJB staff;
- Continuous improvement.

10.3 Principle of priority to nuclear safety in the Czech legislation

The principle of priority to nuclear safety is regulated by the Atomic Act. Chapter 2 of the Atomic Act lays down general conditions for the performance of activities related to the utilization of nuclear energy. Pursuant to Section 4(3) of the Atomic Act:

“Whoever performs practices related to nuclear energy utilization or radiation practices shall proceed in such a manner, that nuclear safety and radiation protection are ensured as a matter of priority.”

The above-quoted principle is contained in all other legal regulations, which are related to the Atomic Act in the Czech legal system and break down into details its basic requirements (see Chapter 7).

10.4 Implementation of principles established in the legislation

ČEZ, a. s. strategy in the area of nuclear safety, priority to the safety principle, safety culture

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, personnel 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.

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 ČEZ, a. s. keeps developing the conditions for fulfilment of the above safety obligations (strategic goals) in compliance with the Safety and Environment Protection Policy, internally drafted, and approved and declared by the Board of Directors.

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 Managing Director of Production Division of the ČEZ, a. s. as well as the tasks of the Action Plan for improvement of safety culture for both power plants.

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 Rules “Organization structure, the role and powers of particular departments” and “the manual of Integrated Management” along with related Directive “Safety Management of 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 monthly reports, the company's managers thus obtain the feedback for assessment of safety requirement implementation success-rate.

To solve the most significant (principal) safety issues related to the operation of nuclear installations, advisory bodies of Chief Operation Officer and Production Manager operate on the top management levels of the ČEZ, a. s. Selected representatives of the decisive special departments and joint sections of the company as well as invited specialists and visitors, they work in the advisory bodies (Committee on the Safety of ČEZ, a. s. Nuclear Installations and Committee on the Production Section Safety). 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 company ČEZ, a. s., has established its commitment to safety as the first of the five company principles. Therefore, safety culture is a part of the company culture as well as the Safety and Environmental Protection Policy. All planned changes as well as conduct of employees are assessed in terms of safety, in particular nuclear safety.

Supervision of nuclear safety

The Atomic Act represents for the SÚJB a basic legal document for the performance of the state supervision. As described in Chapters 7 and 8, all SÚJB activities, its organizational structure and work procedures are governed by the said principle. The independent position of the SÚJB within the state administration, as well as the fact that it is funded directly from the state budget, guarantees sufficiently its main purpose.

Within the scope of its authority and competence, the SÚJB performs checks on observation of the “priority to safety” principle, as established by the Atomic Act, in the course of all activities related to the utilization of nuclear energy and performed by other subjects. All organizations which participate in design, manufacturing, construction and operation of nuclear power plants are subject to the SÚJB inspections, which assess especially the management approach to safety related issues and how individuals performing safety related activities are motivated in respect to this issue.

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 that any person performing or providing for practices related to nuclear energy utilization, shall have an implemented quality assurance system to the extent and in the manner set out in an implementing regulation (Section 4(8) of the Atomic Act). This is the SÚJB Decree No. 132/2008 Coll., on quality assurance system in carrying out activities connected with utilization of nuclear energy and radiation protection and on Quality assurance of selected equipment in regard to their assignment to classes of nuclear safety. Quality Assurance Programs for the activities being licensed shall be approved by the SÚJB.

Documentation of the licensee's – ČEZ, a. s. – quality assurance system includes the commitment to arrange for sufficient financial resources available for assurance of the safe operation of the company's nuclear power plants. This commitment is included in the company's Organization Rules. In connection with ČEZ, a. s. Safety an environmental protection policy, the provision of sufficient resources for assurance of nuclear safety and personnel 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 company 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 on the basis of the life and reliability management programs, their related 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 Production Division management and company management levels of ČEZ, a. s., according to the Signature Rules of the company and 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 wastes, including those generated at nuclear power installations, is regulated by Section 4 of the Atomic Act (Sections 24 – 31). The Section 24 stipulates:

"An owner of radioactive waste or other natural person or legal person managing the assets of an owner in such a manner that radioactive waste is generated (hereinafter referred to as "generator") shall bear all costs associated with its management, from its time of origin to its disposal, including monitoring of radioactive waste repositories after their closure, and including the necessary research and development activities."

Further, the Section 25 and Section 27 paragraph 2 of the Atomic Act establishes as follows:

"Under the terms of this Act, the State guarantees safe disposal of all radioactive waste, including monitoring and supervision of repositories after their closure."

”Generators shall allocate to their own debit financial provisions to cover expenses for disposal of radioactive waste which have been arising or will arise“.

Financial means to be used to cover costs associated with radioactive waste and spent fuel storage are, in accordance with the Atomic Act, deposited by the waste generators to an account held with the Czech National Bank, the so-called “Nuclear Account”. The amount and method of payments to the Nuclear Account are determined by the government of the Czech Republic through its regulation. 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 by the Atomic Act.

The Radioactive Waste Repository Authority (SÚRAO) was founded as the organizational body of the state by the Ministry of Industry and Trade to carry out activities related to radioactive waste disposal. Activities of the SÚRAO are carried out under the government approved statute, budget and annual, three-year and long-term plan of activities. To cover the activities of the Authority, the Ministry of Finance transfers financial means from the Nuclear Account to a separate account of the Authority on the basis of the government approved plan of activities of the Authority and its 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 departments (their activities also include the issue of cold waste, decontamination and technical issues concerning decommissioning) integrated into Safety Section in Production Division. The training of personnel is executed within uniform training system (see also subsection 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 5.0, SÚJB, March 2014. [11][11-1]

Decommissioning

The basic obligations of a licensee as specified in Section 18(1) h) of the Atomic Act include the obligation to evenly create financial reserves for the preparation and actual decommissioning of

[11] https://www.sujb.cz/fileadmin/sujb/docs/zpravy/narodni_zpravy/NZ_VP_RAO_5_0a.pdf

nuclear installations. The amount of this reserve shall be established based on the decommissioning technology approved by the SÚJB and based on the estimate of the costs for given decommissioning technology verified by the SÚRAO. The method of creating reserves is governed by a separate legal regulation issued by the Ministry of Industry and Trade of the Czech Republic. The creation of reserves is controlled by the SÚRAO. Currently, proposals for the decommissioning method have already been approved 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). Monetary reserves for decommissioning are created in compliance with legal regulations for all nuclear facilities operated by the ČEZ, a. s. The funds for decommissioning of nuclear installations are kept on a blocked account and can only be used for preparation and implementation of decommissioning.

The issue of decommissioning documentation preparation is assured at the licensee - ČEZ, a. s. by permanent multi-job work team consisting of the experts of Production Division and Administration Division whose knowledge and experience can be utilized in preparation of decommissioning. In terms of organizational system, the team members are the representatives of the following departments: Fuel Cycle, Safety, Central Engineering and Analytical Support of Production Division. The team 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 quality assurance adopted within the ČEZ, a. s. and included in quality assurance programme for nuclear activities.

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 1994-1997, this field was covered by government declaration (guarantee). In 1997, the Atomic Act came into effect 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.

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 222 million) to CZK 8 billion (approx. EUR 296 million). The operator is now obliged to take out nuclear facility operation damage liability insurance in the minimum limit CZK 2 billion (approx. EUR 74 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 USD 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 insurance for operators of nuclear installations. However, its amount is left to the contracting states. The amount of CZK 2 billion for nuclear power installations (or 300 million for other nuclear installations and transportations) 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 provides 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.

The proposal to enshrine the liability for damage caused by nuclear event in a separate act is currently being prepared under the responsibility of the Ministry of Industry and Trade.

11.2 Human resources

11.2.1 Personnel qualification and training

Legislation

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

Section 17(1) i) of the Atomic Act introduces the following general obligation to the licensee: *"Entrust performance of the specified activities only to such persons who fulfil conditions of special professional competence and are physically and mentally sound, and for persons performing sensitive activities under a specific legal regulation verify their competence in respect to security in a manner laid down in a specific legal regulation".*

Pursuant to Section 18(1) o) the licensee is also obliged to: *"Provide a system of training and verification of competence of personnel in accordance with the importance of the work they perform".*

Preconditions for performance of activities directly influencing nuclear safety are established by the provision of Section 18(3) of the Atomic Act. Such activities may only be performed by persons, who are physically and mentally fit, with professional competence verified by the State Examining Board and to whom the SÚJB has granted an authorization for the concerned activities, upon an application by the licensee.

Professional training of the selected personnel of nuclear installations may, according to Section 9(1) n) of the Atomic Act, be organized by a physical or legal entity only based on a respective licence granted by the SÚJB. Documentation required for the issuance of such a licence is listed in an Appendix to the Atomic Act.

SÚJB Decree No. 146/1997 Coll., as amended by SÚJB Decree No. 315/2002 Coll., in compliance with the quoted provisions of the Atomic Act, specifies activities with immediate impact on nuclear safety and activities particularly important for radiation protection, requirements for qualification and professional training, method of verification of special professional competence and authorization process of the selected personnel, as well as the format of required documents to obtain a licence for training of selected personnel.

The above-mentioned legal regulations have been complemented with the Safety Guide BN JB-1.3[12] issued in December 2010 by the SÚJB, covering professional education and training of personnel 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 for nuclear safety, with the objective to minimize risks caused by human failure.

[12] https://www.sujb.cz/fileadmin/sujb/docs/dokumenty/publikace/G2_D_final_odborna_priprava_PUBLIKACE.pdf

SÚJB Decree No. 193/2005 Coll., establishes the list of theoretical and practical fields of knowledge that is contained in the education and training required in the Czech Republic for the performance of controlled activities falling within the authority of the SÚJB.

Application of legislative requirements to the holders of licences for operation or construction of nuclear installations

The only guarantor of personnel training, from the Atomic Act viewpoint, within the ČEZ, a. s. is the NPP Training section, which is a part of the Personnel Training Centre Section within the Production Division. The main purpose of this section is to conduct training of personnel for both power plants. The NPP Training section is, in accordance with the internal control documents of the company, responsible for the fulfilment of a concept, strategy and system of professional training of personnel in the area of nuclear activities in the ČEZ, a. s.

Within the meaning of personnel training the activities are carried out in three training centres (in Brno, at Dukovany NPP and at Temelín NPP), which are incorporated in the NPP Training section in terms of organization.

The competent managers at all management levels are responsible for the professional competence (qualification) of their subordinates. Principles governing the process of personnel professional training in respect to nuclear activities are described in the internal instruction.

NPP Training section, as a guarantor of the process, permanently keeps, in accordance with the provision of Section 9(1) n) of the Atomic Act, the validity of the SÚJB licence for the training of nuclear installations personnel as well as of selected personnel of workplaces with ionizing sources.

The concept of qualified personnel training of ČEZ, a. s.

The objective of personnel training is to assure that each individual of nuclear power plant possesses necessary knowledge, skills and habits required for achieving, maintaining and developing the relevant professional competence. The fulfilment of this objective is verified by examinations and, for selected functions, formally confirmed by authorizations issued by the employer to perform the concerned activities. For each position the requirements for education, professional experience, health and psychical fitness, probity and especially for continued systematic professional training, before they start to perform their respective activities are established.

The personnel training system at the NPP is closely related to the educational system in the Czech Republic. A significant proportion of employees are university graduates or technical high school graduates. For this reason the training process at the nuclear power plant focuses on provision of additional specific knowledge in the area of nuclear installations, acquisition of practical professional knowledge and skills necessary to perform the work concerned. Special attention is paid to the units' main control rooms operators, shift and safety engineers, operation and inspection physicists (the so-called "selected personnel"). Their training is always concluded with examinations before the State Examining Board.

The *personnel training* as a process consists of "specific training" (which is further divided into "basic training" and "regular training") and "professional training".

The process of personnel training starts with recruitment and hiring. New workers are always selected according to the criteria established in the internal control document "Personnel Selection". The selection process includes verification of health and mental fitness of the employees for their future positions.

NPP personnel and supplier training itself is guaranteed by the NPP Training section, which implements and evaluates the personnel training system as a process. The section is also fully responsible for application of new training techniques and means in order to improve the efficiency of personnel training.

The Human Resources Development section administers the central files of personnel qualification maintained for each systematized job at NPP.

Basic, periodic and professional training of personnel of ČEZ, a. s.

The purpose of *basic training* is to acquire or to improve specific professional capability necessary for performance of a given work activity. The basic training is obligatory for each employee who performs a work activity important for nuclear safety or radiation protection. The basic training shall be provided to all new employees and to the employees trained for different work.

The employees are assigned to one of the training groups according to their work activity and professional specialization. Their specializations are another criterion for their assignment. From the viewpoint of nuclear safety the following training groups are defined, for:

- management,
- NPP selected personnel,
- employees of NPP engineering departments,
- NPP shift and non-shift operating personnel,
- NPP maintenance personnel,
- suppliers' management,
- suppliers' preparers.

In line with SÚJB Decree No. 307/2002 Coll., on radiation protection, as amended by SÚJB Decree No. 499/2005 Coll., and SÚJB Decree No. 389/2012 Coll., three groups of training are defined in terms of training management and performance in the field of radiation protection:

- selected workers,
- exposed workers,
- other employees.

The training is executed according to approved training programs drafted in co-operation between the guarantor of preparation (Preparation Department of NPP) and special departments of NPP. The minimum duration of the basic training meets the requirements of SÚJB Decree No. 146/1997 Coll. The forms of basic training are as follows:

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

The individual mutually linked-up parts of theoretical and practical training are combined into modules, and the whole duration of the basic training varies from 6 to 88 weeks, depending on the type of work to be performed after training.

A specific form of the basic training is also the preparation for a change in work activity (re-qualification) that is the same as the basic training defined by training programs prepared in compliance with the requirements of SÚJB Decree No. 146/1997 Coll.

“Periodic training” serves to maintain and deepen specific professional competence of an employee as required to carry out his/her defined work. Each employee who performs an activity important for nuclear safety or radiation protection is obliged to undergo periodic training.

The forms of periodic training are as follows:

- training days organized for shift and non-shift personnel,
- recurrent specific training - training on emergency preparedness, an access to controlled area, physical protection, etc.,
- recurrent professional training - occupational safety training, fire protection training, training on professional competence in electrical engineering according to the requirements laid down in Decree No. 73/2010 Coll., on specification of dedicated electrical technical equipment, their ranking into classes and groups, and on detailed conditions of their safety, training on professional competence in the position of revision technician pursuant to Decree No. 18/1979 Coll., (specifying dedicated gas equipment and stipulating certain conditions to assure their safety), recurrent training at a full-scale simulator,
- training and examination to renewal of Authorization.

Total duration of particular forms of periodic training differs according to the type of work activity and the minimum duration meets the requirements of SÚJB Decree No. 146/1997 Coll., and it ranges from several hours to two weeks (simulator) a year according to the type of work activity.

The purpose of “professional training” is to maintain, update, deepen or improve the specific professional competence of an employee as required to carry out his/her work. Each employee whose work involves nuclear installations is obliged to undergo the professional training. The exposure to professional training is very important for employees who perform activities important for nuclear safety or radiation protection since the training represents a precondition for continuing validity of the Authorization. Duration of this form of training depends on the type of work activity and may be carried out as a one-off training or long-term course.

Training of Dukovany NPP personnel at a simulator

A full-scale simulator VVER 440 is used for basic and periodic training of Dukovany NPP personnel – a replica of the main control room or a full-scale display simulator, both situated directly at the power plant site.

The replica-type main control room simulator (FSS) is a high-fidelity copy of the operating personnel workplace in the main control room, with all counters and operating panels, including all instrumentation and information system screens placed therein. The simulation of technology, technological processes as well as the control and management system is performed on a modern computer system supplied by the SGI company using simulation software supplied by the GSE and OSC companies.

The simulator also includes a separate workplace for the instructors, with the so-called instructors station, from which the instructors control 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 operating personnel etc.). Communication between the training main control room staff and the instructor is via a closed circuit telephone line. The instructor has also camera system with recording device at disposal as well as a multiple-function classroom for evaluation of the training and theoretical part of teaching.

In the past, the Display Simulator (DS) has been particularly used to train control operators during implementation of new systems in the framework of "I&C Renovation" projects. The training was organized in such a way that most courses will be executed at a full-scale simulator (FSS). At present, the Display Simulator is primarily used during emergency exercises and for engineering purposes.

Training of Temelín NPP personnel at a simulator

The concept of training provided to the qualified personnel at Temelín NPP essentially follows the pattern used at Dukovany NPP.

The training of Temelín NPP personnel is performed at a full-scale VVER 1000 simulator on the site.

The workplace of operators has been designed identically with the real main control room and the construction part of the simulator hall has been adjusted accordingly. The simulation of technology and technological processes is performed on a computer system using simulation software supplied by the GSE and OSC companies. This company also supplied counters and panels, including instrumentation, for the full-scale simulator; identical counters and panels are used in the main control room.

The same as at simulator VVER 440, here the training is also controlled from the instructor station and the communication and recording device is also available. A part of a full-scale simulator is also a multiple-function classroom used for the needs of theoretical teaching and training evaluation.

A display version of the VVER 1000 simulator has also been developed at the Temelín site, which is currently used both for training and for engineering purposes.

Organization and provision of training at simulators

Operator training at simulators is carried out according to the timetables in line with the training programs approved by the SÚJB and the needs of NPP operation. Practical tests carried out at full-scale simulators form an integral part of state examinations of main control room operators.

Training instructors at the simulator at both sites are highly qualified personnel of the NPP Preparation section having minimum experience as a unit shift supervisor or control room supervisor and supplementary educational knowledge. The same as control operative personnel, the instructors also have their training program of periodic training whose regular participation is helpful for keeping their knowledge and skills up-to-date.

Scenarios of all training activities in the given course according to the approved training plan are prepared, tested and approved for training implementation. The scenarios cover the following operating modes:

- normal operating states of a unit (startup, shutdown and operation of the unit, systems and components at different power levels),
- liquidation of error (abnormal) conditions of the unit,
- liquidation of emergency (exceptional) conditions of the unit.

Scenarios of training tasks also contain a list of used and related documents, 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 personnel workplace to solve tasks to the similar extent as in the real main control room.

When using simulators the main focus of attention is on the training of main control room personnel and shift and safety engineers. The simulators are also used for coordination training of personnel of the emergency response organisation (selected members of the Technical Support Centres), reactor physicists and other personnel of operating and technical departments.

Full-scale simulators are also successfully used for validation of operating procedures, preparation and verification of test procedures for emergency exercise simulation, SBO coordination exercise and for other analytic activities.

Professional training provided to employees of external suppliers

The process of personnel training in the case of employees of NPP external suppliers is, as well as that of the NPP's own personnel, comprised of basic, recurrent and specific training. The NPP Training section covers this part of training. Requirements for the professional competence of external personnel depend on the ČEZ, a. s. needs for providing activities, especially activities related to maintenance and repair of the equipment. The system is based on fundamental assurance of professional qualifications by the supplier, completion of professional training in accordance with the ČEZ, a. s. requirements.

Types of training obligatory for individual employees are established by internal control documents. The external suppliers are required to have their training system and qualification assurance described in their own documents, including a method to prove fulfilment of requirements for the professional competence.

Evaluation of training

Evaluation of training and verification of personnel capability is a precondition needed to establish efficiency and effectiveness of 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 professional training are modified aimed at improving its effectiveness. The basic information sources used for a systematic evaluation of the professional training include direct verification of personnel knowledge and evaluation of the standard of training processes by managers, trainees and instructors.

Preparedness of organization

The process model of the Integrated Management System ensures personnel sufficiency at a nuclear installation. It describes all the processes, including supervisors. The same applies to the involvement of suppliers in operational processes.

The process of complementing workers to the organization is closely linked to the educational system in the Czech Republic. It provides a wide range of secondary technical education and a strong group of technical universities. Narrowly specialized workers are then provided by the Faculty of Nuclear Science and Physical Engineering of the Czech Technical University in Prague. However, the current labour market allows to complement experts from other countries.

Personnel competence, availability and sufficiency for the field of emergency preparedness are addressed in Chapter 16.

Role of the regulatory body in the supervision of human resources

The issues of the sufficiency of human resources are included in 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 17(1) b), as one of the general obligations of a licensee, the obligation to:

"Assess in a systematic and comprehensive manner the fulfilment of conditions set in Section 4, from the aspect of the current level of science and technology, and ensure that the assessment results are put into practice."

This requirement of the Atomic Act is further specified in SÚJB Decree No. 106/1998 Coll., on nuclear safety and radiation protection assurance during commissioning and operation of nuclear facilities, in which the Section 14 imposes upon the licensees the obligation to review and modify the operating procedures so that they conform to the current level of science and technology, and at the same time reflect the operational experience and practice. The examination of human impact on operation safety is one of the basic components of the process.

Therefore, human factors are considered in both the project itself and the process of subsequent modifications (see subsection 18.3).

Human impact assessment

The monitoring of human impact on the occurrence and development of operational events is performed by the Dukovany NPP and Temelín NPP Feedback departments and is in accordance with the relevant common control documentation valid 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 regular assessments of operational events in individual nuclear power plants have proven that a significant proportion of these events were caused by one or another form of human failure, either directly, by operator's error during performance of particular activity or human failure in other fields (documentation, design, etc.).

Within execution of the analyses of operational events at which investigation process the human error impact during performance and/or control of activities was identified, the human performance analysis is executed. The procedure of human impact analysis is executed according to methodology HPES (Human Performance Evaluation System). The approach to execution of human impact analysis is based on the principle no blame policy (culture), 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 departments of NPP and supplier organizations.

The causes of human failure are assessed and confirmed by the Failure Commission at the plant (each NPP has its own Commission). Based on the respective analysis corrective measures are imposed aimed at effectively ensuring that the same deficiencies in human performance 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 with the minimum 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 absolutely 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.

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 continuous evaluation of human performance and its comparison in time, human performance indicator was created that is counted as the rate of weighted actual and criteria results from identified direct causes of human error impact upon the events.

A QLV team has been set up at the Temelín NPP, which monitors and analyses the outputs of the key activities of divisional program, processes and activities, which have an impact on the occurrence of individual or system errors in the area of QLV. The purpose of the team is also to ensure the application of instruments to reduce the number of human errors and eliminate barriers to the achievement of excellent results in the area of QLV.

A new “Dukovany NPP Human Factor Reliability Management Program” has been set in place at the Dukovany NPP, which aims to minimize human errors, which result or could result in occurrence of events in operation of the Dukovany NPP. Therefore, the program promotes the good behaviour of personnel and management preventing human errors and creation of rigid organizational barriers. This program is managed by the so-called “Management Committee for Human Reliability at Dukovany NPP”, which is responsible for setting standards, expectations and goals of the program at the Dukovany NPP in line with company's standards, expectations and goals; managing program implementation at the Dukovany NPP; examining reports on program self-assessment by particular divisions of the Dukovany NPP; processing program self-assessment for the entire Dukovany NPP; approving proposals and recommendations, and adopting decisions to improve program performance at the Dukovany NPP.

Organizational changes

Organizational changes in operator structure are categorized by their impact on nuclear safety, radiation protection, physical protection, emergency preparedness and technical safety in a graded approach. The changes are then authorized or notified by the SÚJB depending on the degree of their impact. 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 success of the organizational change made shall be assessed within an adequate interval of time.

12.2 Role of the regulatory body in the human and organizational factor assessment

The SÚJB systematically monitors the impact of human and organization factors on the operational safety. Conclusions of the plant's so-called “Failure Commission” are discussed at regular meetings. 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 part within PSR process.

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) the SÚJB shall establish for this purpose a state examining board and identifies activities with immediate impact on nuclear safety. Verification is carried out in form of an exam before the state examining board.

This exam consists of theoretical written and oral part, and a practical part, including examination at a simulator. The state 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. A failed exam may be repeated by the applicant within a 1 - 6 months period whereby the specific date shall be determined by the state examining board. Under a respective implementing regulation an individual who has successfully passed the exam in front of the state examining board is granted a selected personnel authorization by the SÚJB for a period of 2 to 8 years.

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 Quality assurance legislation

The Atomic Act establishes general conditions for the performance of activities related to the utilization of nuclear energy, radiation practices and interventions to reduce radiation exposure pursuant to the provisions of Section 4(8):

"Any person performing or providing practices related to nuclear energy utilization or radiation practice, except the activities according to Section 2 a) items 5 and 6, must have an implemented quality assurance system, to the extent and in the manner set out in an implementing regulation, aimed at achieving the required quality of a relevant item, including tangible or intangible products, processes or organizational arrangements, with respect to the importance of this item from the aspect of nuclear safety and radiation protection. The implementing regulation shall set basic requirements for quality assurance of classified equipment with respect to their safety classification."

In this case, the implementing regulation is SÚJB Decree No. 132/2008 Coll., which regulates in detail:

- the requirements for quality system in execution or assurance of the activities related to the utilization of nuclear energy or radiation activities,
- the requirements for the substance of quality assurance programs,
- the criteria for classification and division of classified equipment into safety classes,
- the basic requirements for quality assurance of classified equipment with regard to their classification into safety classes, and
- the scope and the method of preparation of the list of selected facilities.

Pursuant to Section 13(5) of the Atomic Act, a license to be issued by the SÚJB for specified activities in the utilization of nuclear energy and ionizing radiation shall be conditional upon an approved quality assurance program for the licensed activity (see Chapters 7 and 8).

13.2 Quality assurance strategy of the licensee - ČEZ, a. s.

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

The system is designed in such a way that assurance of the processes and activities important in terms of nuclear safety or radiation protection will be executed in a controlled and organized manner and completely pursuant to the Atomic Act and its implementing decrees including SÚJB Decree No. 132/2008 Coll. The requirements of quality system are applied by means of a graduated approach according to the importance of particular processes and items for nuclear safety and radiation protection.

The system is in compliance not only with legislative requirements (SÚJB Decree No. 132/2008 Coll.)

but also it is harmonized both with generally recognized criteria standards ISO (ISO 14001, ISO 27001 and ISO 50001, and program Safe Business) and with specific recommendations of IAEA (GS-R-3).

In 2010, ČEZ, a. s., became a signatory to the Quality Charter of the Czech Republic and thus adopting its commitments. Fulfilment of the commitments of the Charter was supported by the ČEZ, a. s., in October 2010 by founding a specialized section of the Quality Council of the Czech Republic called Quality in Energy, of which ČEZ, a. s., is a manager and founding member.

- The Safety and Environmental Protection Policy was declared by the Board of Directors of ČEZ, a. s., and is merged with the Management Quality Policy from 2015.

Strategic pillars of this policy are as follows:

- We place the protection of human life and health before other interests.
- We promote the safety and environmental protection as an integral part of management.
- We comply with the legal regulations and public commitments, and take the recognize practice into account.
- We continuously develop the approach to safety and environmental protection.
- We regularly assess, prevent and eliminate risks or reduce their impact to the acceptable level.
- We make sure that technologies meet the safety, environmental, economic and technical requirements on a long-term basis.
- When selecting and evaluating suppliers, we take into consideration their approach to safety and to the environment.
- We openly discuss safety-related topics and impacts of our activities on society and the environment.
- We grant sufficient qualified and responsible workers.
- We manage key knowledge.

To fulfil the Management Quality Policy, the correct setting, evaluation, documentation and improvement of the management system, including internal processes, are required. In 2011, the *Integrated Management System* project was completed and evaluated. The ČEZ Group assists to meet the ever-growing requirements for quality and safety requirements for supplies, products and services, and creates conditions for efficient process and line management in all areas.

The ČEZ Group declares compliance with and high level of safety, environmental protection and quality through the certificates obtained and regularly renewed. All nuclear, conventional and hydroelectric power plants of the ČEZ, a. s. are long-term holders of the ISO 14001 certificate and Safe Enterprise. The certification processes apply also to the ČEZ Group companies acting abroad.

The Management System department, directly subordinate to the Director General, has been established in ČEZ, a. s. to guarantee the commitment to and demonstrate the involvement of management in introduction, evaluation and continuous improvement of activities, which provides the strategic management with efficient feedback for the management system.

The ČEZ Group Safety Inspectorate department of was established to provide the strategic management with feedback over compliance with the requirements in the safety area.

13.3 Quality assurance programs for all lifetime phases of nuclear installation

For verification of introduced quality system for granting the SÚJB licence pursuant to Section 9(1) a) to g), i), j), l), n) and r) of the Atomic Act for activities licensed by the SÚJB, the documents of the type of quality assurance program are prepared.

Quality assurance program has the character of licence document whose contents substance is stipulated by Sections 10 and 11 of SÚJB Decree No. 132/2008 Coll. The document describes quality assurance system of the licensee, affected processes and activities including the processes and activities performed as the supplier as well as necessary documented procedures relating to the relevant licensed activity determined in the Atomic Act.

In compliance with the provisions of Section 13(5) of the Atomic Act, ČEZ, a. s. has quality assurance programs approved by the SÚJB for licensed activities for particular stages of the life cycle of respective nuclear installation.

The preparation, review, approval, recording, archiving including execution of revisions of documents of the Quality Assurance Program type within ČEZ, a. s. are described by the methodology "Preparation of quality assurance program and change/reconstruction quality program".

The top document the "Manual of Integrated Management System" is also Quality Assurance Program for licensed activities pursuant to the Atomic Act, Section 9(1) d), e), f), i), j) and n), i.e. for:

- operation of a nuclear installation or category III or IV workplace,
- restart of a nuclear reactor to criticality,
- reconstruction or other changes affecting nuclear safety, radiation protection, security and emergency preparedness of a nuclear installation or category III or IV workplace,
- ionizing radiation sources management to the extent and in the manner established in an implementing regulation,
- training of classified employees

and verifies fulfilment of the requirements of SÚJB Decree No. 132/2008 Coll., on quality system in execution and assurance of the activities related to the utilization of nuclear energy and radiation activities and on quality assurance of classified equipment with regard to their classification into safety classes in quality system of ČEZ, a. s.

13.4 Main instruments in the application and efficiency evaluation of the management system

The management system of ČEZ, a. s. is focused on application and extension of process approach to management and it consists of the basic areas of management, the areas of management and processes. The basic areas of management are logically classified into the groups – the areas of management. For each area of management, the Director General or the Director of Division designates the competent guarantor.

Particular areas of management and processes are interconnected via interfaces that are defined by the products provided by one area of management (process) to another area of management (process). These interfaces utilize (internal and external) customer-supplier principle. Competent guarantors are responsible for the condition of set interfaces. Checking system is set for implementation of checking activities within the process.

The requirements of management system for documenting and description of the elements, levels and forms of management within ČEZ, a. s. description of functional duties, responsibilities and powers, line structure of the company and assurance of efficient planning, operation and management of processes and activities are supported by the system of documents with its structure and classification into the groups and types of documents.

The method of management is described in the Organization Rules of ČEZ, a. s. and in a set of control documents defining, in addition, the control mechanisms and determining the indicators for evaluation.

Strategic management is responsible for the introduction, use, evaluation and continuous improvement of management system, i.e. it is responsible for the fact that the duties, tasks and powers related to quality, environment, energy management and safety management system are within ČEZ, a. s. determined, documented and communicated in such a way that they support efficient management.

The Management System Department, directly subordinate to the Director General, has been established in ČEZ, a. s. to guarantee the commitment to and demonstrate the involvement of management in introduction, evaluation and continuous improvement of activities, which provides the strategic management with efficient feedback in the following matters:

- Development coordination, the introduction and maintenance of determined parts of management system as well as its evaluation and continuous improvement.
- Reporting concerning management system performance including its effect upon safety and safety culture and any needs for improvement.
- A solution to any potential conflicts within management system processes.

Each employee is responsible for quality of his/her work. The staff executing checking and verifying activities have sufficient powers to be able to identify non-conformances and to require their correction, if necessary. All staff of the company is entitled to make proposals for system improvements and modifications.

ČEZ, a. s. assures development and strategy of management of human resources in such a way that the staff whose labour performance affects safety, quality, environment etc. will be competent based on their acquired education, training, skills and experience. The staff education in the field of quality is graduated and focused on understanding of management system and all necessary tools and methods enabling its improvement.

Within the company, so-called “graduated approach” is introduced, especially in relation to safety and subsequently to economy.

In case of occurrence (identification) of non-conformance having impact on nuclear safety, radiation protection, security and emergency preparedness, a “conservative approach” is always applied to minimize risks, even at the expense of potential economic losses.

The management system includes efficient mechanisms for identification of non-conformances and their effective correction. Where stipulated by legal regulations and agreed requirements with external involved parties, a specific procedure for correction of the types of non-conformances determined in these external inputs is applied.

The effectiveness and efficiency of management system is monitored and evaluated within checking system based on the principle of systematic and periodic execution of comparison with predefined requirements, expectations and objectives determined in a sufficient scope and depth. Based on the evaluation and analysis of achieved results, possibly the analysis of the data detected in checking activities, objective conclusions are drawn resulting in the proposals of efficient corrective measures and the proposals of preventive measures.

Within checking system, the following degrees are applied:

- internal checking system (continuous assessment, self-assessment, benchmarking),
- independent evaluation (internal, external),
- management of non-conformities / events / topics for improvement,
- management system review.

Internal checking system has cross-sectional character. It represents necessary feedback in control process and due to its provided information it has a significant effect upon decision-making process. It represents all activities of executives by means of which the executives detect whether achieved results comply with planned ones. It is understood as review of reliability performance and efficiency of management at all management levels for the purpose of continuous improvement. The methods of internal checking system include mainly “self-assessment”.

Independent evaluation including analytical activities is applied where it is required by generally binding regulations (an effect upon nuclear safety, radiation protection, engineering safety, etc.) or where this is purposeful.

The methods of internal independent evaluation include internal audits, management system evaluation, environmental and OHS audits, monitoring of nuclear activities, independent supervision of safety management system for strategic management, supplier evaluation and qualification, customer and stakeholder satisfaction evaluation, joint checks and independent evaluation in processes. The methods of external independent evaluation include supervision by state bodies, certification/verification audits or reviews, transnational and peer reviews by experts and technical reviews.

The employees executing independent evaluations are classified into organization structure of ČEZ, a. s. in such a way that it will be assured that they do not have any direct relation to evaluated activities. If any conflict of interest in relation to the subject-matter and specification of evaluation can be expected, a particular employee is not authorised to execute independent evaluation.

The management system review is executed at regular intervals, specifically at the level of certified area of management (the Environment, Industrial Safety, and Energy Management) and at the level of ČEZ, a. s. for the field of management system. A part of the review is also review of policies and objectives.

The management system review report is prepared by Management System Department as the background paper for review executed by strategic management with regard to determined policies and objectives once a year.

Based on the review results, strategic management decides concerning the measures related to:

- efficiency improvement of management system and its processes and the need for execution of changes in management system,
- resources needs, a possible need for a change in policies, objectives, target values or another management system element in compliance with the obligation of continuous improvement.

Special processes

Activities, which may be identified in the framework of the term “special processes”, are particularly included in the process “Activities related to the care of assets” during work implementation in the framework of the area of management “Care of assets” and in the area of management “Technical safety”. These are the methods of non-destructive testing, welding and post heat treatment. In manufacturing of spare parts for maintenance, this is the method of post heat treatment of spare part material. Prepared are working documents (methodologies, shared documentation, etc.) for the activities related to welding, diagnostics and non-destructive testing.

Procedures or requirements for these activities, requirements for personnel qualification, for equipment, requirements for validation records and procedures are provided for in the relevant methodologies, shared documents, technical specifications and other working documents.

The activities mentioned above are outsourced, except for the activities carried out by technical safety and technical inspection personnel in the area of non-destructive testing. For activities carried out by a contractor, the ČEZ, a. s., carries out the inspection activities (customer supervision), as described in control and working documents.

In compliance with the requirements laid down in SÚJB Decree No. 132/2008 Coll., the ČEZ, a. s., supervises a special welding process through the Technical Safety division, which is organizationally separated from the supervision of welding contractors, which is under responsibility of the Technical Support division in the framework of the area of management “Care of assets”.

Requirements for special processes outsourced to contractors are the subject of the contract documents.

In the company ČEZ, a. s., legal requirements, adopted requirements laid down in standards, guides and other specifications for the area of safety, quality and security are integrated into the management system in the form of control documents and in the form of safety standards. If it is necessary to set out requirements for subsidiary companies or contractual partners, the requirements are contained in mutually approved joint documents of the ČEZ Group or in shared documents (legal entity's documents, which are binding upon another legal entity under the contract concluded between the legal entities). Prescriptive requirements are also set for suppliers in purchasing processes.

Maintenance is performed via contractors. Maintenance system management is carried out so as to ensure stability, efficiency, quality and safety during maintenance and modifications. Work with suppliers is strictly regulated by contracts for work and management system documents of the company ČEZ, a. s.

Suppliers providing services and goods for ČEZ, a. s., (regulated by specific Contracts for Work) are recorded in the relevant business partner monitoring system. Introduction and identification of new business partners, editing, cancellation of business partners, etc., follow the relevant management system documents.

Supervision 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 customer audits and evaluation of the activities carried out by suppliers:

a) Customer audits of suppliers

The aim of the customer audits of suppliers of the ČEZ, a. s., is to systematically verify professional competence and qualification of the existing and potential suppliers in accordance with the specifications of customer requirements, legal regulations, harmonized technical standards and codes. To meet this objective, a graded approach is applied in the verification of suppliers/subcontractors by safety relevance of the subject of the supplies and/or services to be provided.

b) Evaluation of suppliers

The aim of the evaluation of suppliers is, considering the safety relevance of supplied items, to monitor continuously the performance of outsourced processes and activities according to the predefined criteria.

The relevant special divisions (guarantors of processes) are, in the sphere of their competence, responsible for setting out criteria for the evaluation and systematic supervision in accordance with the procedure set out.

c) Spot checks of the working activities 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 technician, 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. Separate checks from a perspective of OHS, fire protection, EMS, etc., are also carried out.

Specific supervision of suppliers or supply chains, in particular for items with regard to their safety relevance, is carried out by special divisions (Maintenance, Purchase, Safety, Supply System Management, Personnel Training Centre, Engineering, and, where appropriate, others) within the scope 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, controls of nuclear safety, radiation protection, fire protection, emergency preparedness, technical safety, inspections of an 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).

13.5 Current state regulatory body practices and its inspection activities in the quality assurance area

The SÚJB, in accordance with Section 39 of the Atomic Act, checks compliance by the licensees with the Atomic Act, including the quality assurance requirements mentioned above. Whenever it is deemed necessary, the inspection activities are extended to include the subcontractor. The inspection activities focus both on the system and on the quality assurance of particular classified systems, structures and components. SÚJB unit primarily performing this activity is the Nuclear Installation Inspection Department (see Organizational Chart of the SÚJB, Fig. 8-1).

In compliance with the Atomic Act SÚJB approves quality assurance programs for nuclear installations dealing with:

- siting,
- designing,
- construction,

- individual stages of commissioning,
- operation,
- restart of a nuclear reactor to criticality following a fuel reload,
- reconstruction or other changes affecting nuclear safety, radiation protection, security and emergency preparedness,
- decommissioning,
- ionising radiation source management,
- radioactive waste management,
- nuclear materials management,
- training of classified workers,
- performance of personal dosimetry and other services important from radiation protection point of view.

In accordance with the Atomic Act an approved quality assurance program is one of the preconditions for the issue of a licence for the activities specified in Section 9(1) (see Chapter 7). Criteria for the assessment of quality assurance programs are established in SÚJB Decree No. 132/2008 Coll., and other binding regulations and standards.

The SÚJB also approves the List of Classified Systems, Structures and Components, a document listing items important from the viewpoint of nuclear safety, divided into three safety classes in accordance with the criteria specified in Appendices to SÚJB Decree No. 132/2008 Coll., which are in accordance with IAEA criteria.

To issue a licence for a nuclear installation siting the SÚJB shall consider the following, as part of the Initial Safety Report:

- quality assurance assessment during siting processes,
- quality assurance method for construction preparation,
- quality assurance principles for the following stages.

To issue a licence for the construction of a nuclear installation the SÚJB shall consider the following, as part of the Initial Safety Report:

- quality assurance method in the preparing phase of construction,
- quality assurance method in the construction implementation,
- quality assurance principles for the following stages.

For the approval for first fuel loading, the SÚJB shall consider quality evaluation of the classified equipment as part of the Final Safety Analysis Report.

Currently, the legislative procedure is underway to adopt the new Atomic, which will help the state administration to direct more efficiently the steps in siting, construction, commissioning and operation of new units of nuclear power plants. The standard-making process is conducted at the same time for the preparation of implementing decrees.

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 lifetime of a nuclear installation. The requirements specified in Article 13 of the Convention are fully complied with.

14. Safety Assessment and Verification

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 17 of the Atomic Act, the licensee shall verify nuclear safety during all stages of the installation's service life (in the scope appropriate for the particular licences), asses it in a systematic and comprehensive manner from the aspect of the current level of science and technology, and ensure that results of such assessments are translated into practical measures. The verification/assessment shall be documented. The content of the documentation is specified in the Appendix to the 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 implementing legal regulations of the Atomic Act and SÚJB Safety Guides are basic criteria for nuclear safety assessment of a nuclear installation during different stages of its life time cycle.

The following are particularly concerned:

SÚJB Decree No. 215/1997 Coll., on criteria for siting nuclear installations and very significant ionizing radiation sources,

SÚJB Decree No. 106/1998 Coll., on nuclear safety and radiation protection assurance during commissioning and operation of nuclear facilities, which defines and establishes particularly the following: individual stages of commissioning; requirements for the content of the commissioning programs; requirements for the contents of Limits and Conditions for safe operation,

SÚJB Decree No. 195/1999 Coll., on basic design criteria for nuclear installations with respect to nuclear safety, radiation protection and emergency preparedness,

SÚJB Decree No. 309/2005 Coll., on assurance of technical safety of selected equipment. This decree defines the following:

- method of determination of selected equipment specifically designed for nuclear installation,
- technical requirements for assurance of technical safety of selected equipment in production and in operation,
- procedures for consideration of the compliance of selected equipment specifically designed for nuclear installations with technical requirements,
- method of assurance of technical safety of selected equipment in operation.

SÚJB Decree No. 132/2008 Coll., on quality assurance system in carrying out activities connected with utilization of nuclear energy and radiation protection and on Quality assurance of selected equipment in regard to their assignment to classes of nuclear safety.

The requirements referred to in 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, the safety guide for periodic safety assessment, guide for ageing management, guide for probabilistic safety assessment, guide for maintenance, in-service inspections and functional tests, etc.

A number of IAEA recommendations is applied in safety assessment, in particular the following documents: SF-1,,GSR Part 4, GS-G-4.1, SSG-2, SSG-3, SSG-4, IAEA-TECDOC-1106, INSAG-12, ISAG-3, Rev. 1., INSAG-25, SSG 25, NS-G-2.3, NG-T-1.1, IAEA-TECDOC-1141, IAEA-TECDOC-1329 , NS-G-2.12, SRS No. 57 and SRS No. 82, and WENRA documents: WENRA Safety Reference Levels for Existing Reactors, Update in relation to lessons learned from TEPCO Fukushima Dai-ichi accident, 24 September 2014 and relevant guidance for the implementation of reference levels.

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

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 continuous safety verification through inspections, tests and systematic supervision both through internal procedures on the premises of an operator of a nuclear installation and by regulatory body (Chapter 14.2).

As described below, practical application of the requirement to perform systematic and comprehensive assessment of a nuclear installation to check on its continual compliance with its design, applicable safety requirements in the valid national legislation and with Limits and Conditions includes in particular:

- deterministic nuclear safety assessment (Final Safety Analysis Report),
- probabilistic nuclear safety assessment (so called “Living Probabilistic Safety Assessment” and its application - Safety Monitor),
- periodic safety assessment,
- systematic monitoring of nuclear and technical safety (supervision, inspections, tests).

14.1.2 Continuous monitoring and periodic assessment of safety of nuclear installations

Continuous monitoring of operational safety of individual units of the Dukovany NPP and Temelín NPP performed by the licensee focuses in particular on the observation of the Limits and Conditions for safe operation.

This activity is performed both by personnel of the departments responsible for performance of such activities (self-assessment process) and by specialists of the safety departments at both NPPs, who are independent of performed activities and are not responsible for them (independent supervision). Personnel of the safety departments are responsible for independent verification of the fulfilment of test completion criteria during operation and after maintenance, before equipment after maintenance is ready for operation.

Inspections of compliance with additional requirements are executed during outages, dealing with the progress of works and manipulations on technological equipment. The inspections are executed by the personnel of the implementation departments and safety departments of both NPPs as well as by the managers (Management System Review) of departments carrying out work during the outages of units.

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 indices 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 4.1 or 4.2, is used to monitor the operational risk level of all units of ČEZ, a. s, NPPs depending on current equipment configuration. This tool together with the models of respective units are used at Temelín NPP and Dukovany NPP, cumulative and point-in-time 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 optimization at least two months prior to implemented outage, and to evaluate real or intended changes in time schedule during outage. Original and actual course of the risk is 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 status of safety in the Dukovany NPP and Temelín NPP) and discussed on the individual control levels within ČEZ, a. s. The unavailability of the individual components with impact on nuclear safety is monitored monthly. Results of this monitoring are 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, which are a product of the Core Damage Frequency and the duration of the component unavailability.

Deterministic nuclear safety assessment (Final Safety Analysis Report)

The evidence of safety of nuclear power plant units is in compliance with the original and current legislation documented in the Final Safety Analysis Reports for Dukovany NPP and Temelín NPP.

The validity and topicality of Final Safety Analysis Report for Dukovany NPP and Temelín NPP is the basis for issue of the licences both for operation and for startup of individual units after each refuelling outage.

Final Safety Analysis Report for Dukovany NPP and Temelín NPP is regularly updated (changes in and amendments to Final Safety Evaluation Report for the past year are submitted to the SÚJB always once a year).

Final Safety Analysis Report for Dukovany NPP and Temelín NPP is prepared according to the concept based on the US NRC RG 1.70, and it verifies the assurance status of nuclear safety of the units at Dukovany NPP and Temelín NPP in terms of state of the art and experience in the hitherto operation.

The modifications that have an effect upon nuclear safety and that change the preconditions used in Final Safety Analysis Report shall be, according to the nature of the modification, notified or approved by the SÚJB prior to their implementation. The responsibilities of particular departments of power plant in evaluation of impacts of the modification upon particular processes are determined in the relevant control documentation.

Periodic safety assessment

At Dukovany NPP and Temelín NPP comprehensive safety level inspections are executed at regular ten-year intervals using an internationally broadly applied tool, the so-called "Periodic Safety Review" (PSR). These inspections are executed fully in compliance with the requirements and recommendations of IAEA and WENRA. PSR evaluates a total of fourteen areas - Power Plant Project; Actual Status of Systems, Structures and Components; Equipment Qualification for Ambient Conditions; Ageing; Deterministic Safety Analyses; Probabilistic Safety Assessments; Potential Internal and External Risks; Operational Safety; Feedback from the Operation of Other Nuclear Installations, and Science and Research Results; Organization and Control, Quality Systems and Safety Culture; Procedures and Regulations; Human Factor; Emergency Preparedness, Radiological Environmental Impact.

The results of evaluation are stated in final reports of all evaluated areas and in summary report that is submitted to the SÚJB. 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. The results of PSR provided, among others, the basis for preparation of renewal of the licences to continue operation of the units of Dukovany NPP and Temelín NPP after completion of the previous ten years of operation.

Overview of completed / 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. 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 major part is implemented and the remaining ones will be finalized in the time limit for the submission of the application for licence for operation of particular units.

The SÚJB evaluates the Final Reports of PSR, comments on PSR findings and on a list and completeness of corrective measures and annually controls compliance with the time schedule and content of the corrective measures. Any changes in the time schedule for implementation of corrective measures or adopted technical and administrative measures shall be notified and consulted by the licensee 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.

Gradual development of the level 1 PSA model was performed; 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 external human induced events. Modifications implemented 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 detail. Similarly, low-power modes 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 handed over to the state regulatory body in April 1998. Level 2 PSA analyses has been processed only for power operation. In 2002, this analysis were updated through new input data based on the actual 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 executed in 2006. Between 2010 and 2014, the level 2 analysis for non-power conditions and shutdown was gradually incorporated into the portfolio of analysed risks for non-power conditions and shutdown, and the last update of the full-scope level 1 and 2 analysis for all operating power and non-power conditions, both for fuel in reactor core and for fuel in spent fuel storage pool, was then 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 SPSA 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 partial 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 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 modifications 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 level 1 Living PSA study have also been used to support the development of new procedures dealing with emergency and abnormal conditions (level 1 Living PSA) and procedure dealing with beyond design basis accidents (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 and guides for beyond design basis accident management are, in the framework of the concept of the Living PSA, incorporated into the PSA models on a regular basis.

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 modifications to be made, updating of specific reliability data for the units and incorporation of more accurate supporting analyses into the model, 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.

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. Risk-informed in-service inspections (RI-ISI) are yet on the level of pilot project.

The PSA analysis for Dukovany NPP is developed in compliance with international standards (IAEA publication, ASME-2 standard, NUREG publication).

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) initiated by the SÚJB was carried out by Austrian company ENCONET Consulting in 2005. Another IAEA IPSART inspection mission on the PSA for the Dukovany NPP shall take place in 2016.

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.

From 2008 and every thereafter, the SÚJB check was executed concerning the project “Living PSA” of Dukovany NPP, verification of continuous evaluation of operational safety of the units of Dukovany NPP and evaluation of risk profile during outages by means of risk monitoring “Safety Monitor of Dukovany NPP” and safety culture evaluation in the field of PSA analyses.

In subsequent years, the PSA analysis was extended to the full range of internal events and external events caused by human activities, of which only “plane crash” event has a certain contribution to risk, were incorporated therein. External events caused by natural influences (extreme wind, weather, extreme temperatures, etc.) were processed between 2011 and 2014, and included in the overall portfolio in 2015. All modifications implemented 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 level 1 PSA 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 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 LERF, which currently includes all releases of radioactivity from the containment or reactor hall during outage 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 study for individual units of Dukovany NPP (towards the end of 2015). The results include internal events and network degradation and the so-called hazards (fires, floods, falling loads and flying objects).

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

	CDF [$year^{-1}$]	FDF [$year^{-1}$]	LERF [$year^{-1}$]
Unit 1	7.22×10^{-6}	1.13×10^{-5}	1.21×10^{-6}
Unit 2	6.45×10^{-6}	1.05×10^{-5}	1.17×10^{-6}
Unit 3	6.47×10^{-6}	1.06×10^{-5}	1.18×10^{-6}
Unit 4	6.52×10^{-6}	1.06×10^{-5}	1.18×10^{-6}

Overview of CDF, FDF and LERF of Unit 1 for power and shutdown operational modes

Unit 1	CDF [$year^{-1}$]	FDF [$year^{-1}$]	LERF [$year^{-1}$]
2 - 100 % N_{nom}	4.26×10^{-6}	6.92×10^{-6}	7.70×10^{-7}
N < 2 % N_{nom}	2.96×10^{-6}	4.38×10^{-6}	4.40×10^{-7}
Total:	7.22×10^{-6}	1.13×10^{-5}	1.21×10^{-6}

The results of external events are shown in last table. It includes the results of natural events as well as events caused by human activity.

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

	CDF_{ext} [$year^{-1}$]	FDF_{ext} [$year^{-1}$]	$LERF_{ext}$ [$year^{-1}$]
Unit 1	3.56×10^{-5}	3.63×10^{-5}	1.19×10^{-5}
Unit 2	3.54×10^{-5}	3.59×10^{-5}	1.18×10^{-5}
Unit 3	3.26×10^{-5}	3.32×10^{-5}	1.06×10^{-5}
Unit 4	3.26×10^{-5}	3.32×10^{-5}	1.08×10^{-5}

Extreme snow load and extreme wind are the biggest contributors to the risk of external events. The seismic PSA is so far prepared only for the Dukovany NPP Unit 1 but its contribution to the risk is insignificant. Currently, technical changes are prepared to reduce the magnitude of the LERF indicator for external events.

Probabilistic Safety Assessment of the Temelín NPP

The first probabilistic assessments of the Temelín NPP Unit 1 and Unit 2 were developed in 1993 – 1996.

The goal of the PSA project of the Temelín NPP was assessment of 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 substances and to establish the main contributors to such releases. The PSA project of the Temelín NPP included evaluation of level 1 PSA both at power operation, low-power operation and during outages, and the evaluation of risk, fires, 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 possibility of risk monitoring of operation of both units at Temelín NPP. Upon these grounds, the work scope was extended in 1996-1999 and the PSA basic models (for the all operational states and levels 1 and 2) were converted to develop a localized version of the Safety Monitor 2.0 or 3.0 and 3.5 software from the Scientech Company. The main purpose of this software and its related probabilistic models is to analyze the impact of both actual and planned configurations of the NPP, including 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. Validity of the licence for this software was subsequently then purchased 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 in 2001-2003 represent knowledge on the plant's response to emergency, current design and operational condition after the implementation of many safety improvements. This enables us to assess the impact of safety related measures at the Temelín NPP, using the Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) and thus acquire a more realistic estimate of the current safety level in the commissioning and further operational stages.

The main results of the updated PSA models of Temelín NPP for analysed list of internal and external initiating events and the Temelín NPP status at the beginning of 2013 represent Core Damage Frequency estimation of the Temelín NPP Unit 1 and Unit 2:

- CDF = 1.39 x 10^{-5}/ year for operation at power,
- CDF = 9.28 x 10^{-6}/ year for all operating conditions of the outage,
- CDF = 7.42 x 10^{-6}/ year for internal fires,
- CDF = 1.35 x 10^{-6}/ year for internal flooding,
- CDF = below 1.00 x 10^{-8} for seismic events,
- CDF = below 1.00 x 10^{-7} for other external events ,
- Total CDF = 3.2.10^{-5}/year for all operating modes and initiating events,
- Total LERF = 4.04.10^{-6}/year (without application of the SAMGs).

At the same time, a new conversion and migration of updated PSA models to the Safety Monitor software environment version 4.2 from the Safety Monitor software version 3.5 was performed. The software operation, including models, is currently operated in the Temelín NPP network environment and is used especially for optimization of maintenance activities both during operation and mainly during evaluation of each of the outages (time schedule of outage before its start, its potential modifications 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).

Real annual cumulative value of CDF, as a result of Temelín NPP operational configuration risk monitoring, amounts to 1.10 x 10^{-5} for Unit 1 and 1.074 x 10^{-5} for Unit 2 of Temelín NPP for 2012 as compared with average value of calculated CDF from 2012 (1.39 x 10^{-5}).

The PSA is gradually utilized in a number of other applications (in addition to those mentioned above) such as:

- Risk assessment of intended modification of equipment,
- IAEA Safety Issues probabilistic assessment,
- Adequacy assessment of existing Limits and Conditions and proposal of changes in Limits and Conditions (AOT),
- Evaluation of selected risk-severe operational events,
- Assistance in development of EOPs, SAMGs (emergency regulations, guidelines for severe accident management) and measures of power plant improvement in respect of severe accidents,
- Risk assessment of time schedules of shutdowns and subsequent evaluation of actual versus planned course and observance of specified risk criteria of the shutdowns,
- Risk assessment of divergences (BCO).

The PSA study for Temelín NPP is developed in compliance with international standards (IAEA publication, ASME-2 standard, NUREG publication).

The PSA study for Temelín NPP was the subject of the IAEA IPERS mission 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 Austrian company ENCONET Consulting in 2005. Another IAEA IPSART mission is envisaged after update of the PSA models for the Temelín NPP in 2017.

The SÚJB check has been annually executed since 2009 concerning the project “Living PSA“ of Temelín NPP, verification of continuous evaluation of operational safety of the units of Temelín NPP by means of risk monitoring “Safety Monitor of Temelín NPP” and safety culture evaluation in the field of PSA analyses.

14.1.3 Regulatory practice

The SÚJB assesses the level of nuclear safety in the course of the so-called “licensing” procedure to issue licences for activities identified in the Atomic Act and implementing decrees and guidelines, and with regard to international practice. Moreover, the SÚJB assesses the level of nuclear safety assurance within the following activities:

- assessment of the periodically submitted Final Safety Analysis Report (requirements for its submittal are specified in the respective SÚJB resolution),
- evaluation of the in-service inspections program,
- evaluation of the program for the enhancement of nuclear installations safety,
- evaluation of feedback from the operational experience and implementation of the latest scientific knowledge and technology outcomes.

In agreement with the Atomic Act, all results obtained by the SÚJB in the area of nuclear safety assessment as well as verification are regularly 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 already mentioned above in subsection 14.1.1, pursuant to the provisions of Section 17 of the Atomic Act, the licensee shall verify nuclear safety during all stages of the installation's service life (in the scope appropriate for the particular licences), asses it in a systematic and comprehensive manner from the aspect of the current level of science and technology, and ensure that results of such assessments are translated into practical measures. For details concerning the requirements for safety verification during operation see Chapter 19, in particular Chapter 19.3 dealing with maintenance, inspections and tests.

Implementing regulations to the Atomic Act in the form of decrees (for safety verification: SÚJB Decree No. 195/1999 Coll., No. 309/2005 Coll., and No. 132/2008 Coll.) have been elaborated in Safety Guides issued by the SÚJB (in particular, safety guide for maintenance, in-service inspections and functional tests, and for NPP equipment ageing management).

14.2.2 Continuous safety verification programs

Continuous safety assessment, with the aim to monitor and maintain the level of nuclear and technical safety, is ensured at the Dukovany NPP and the Temelín NPP by introducing a comprehensive strategy of the care of assets. The strategy is based on a graded approach to equipment according to its relevance (functional relevance) and legislative requirements. The graded approach is based 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).

Implementation of the care of assets:

1. **Records of assets/systems, structures, components (SSC)** – records of process assets (SSC) of the power plant are kept in accordance with the control 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 control and working documentation.
3. **Classification of assets (SSC)** – power plant SSC is classified by its 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) and taking account of the relevance of equipment function to the fulfilment of safety and production requirements imposed on equipment and is classified by relevance into three categories (cat. 1 – critical, cat. 2 – non-critical, cat. 3 – irrelevant).
4. **Identification of classified SSC (Group A)** on the basis of ČEZ_ST_0006 and ČEZ_ME_0987, for which ageing should be managed with the use of component specific/specific ageing management programs).
5. **Establishment of the preventive maintenance program and its implementation –** the program is established in a graded approach depending on the equipment category. In addition to legislative requirements, it includes other preventive actions to maintain the required level of reliability and equipment lifetime. The program is established with the use of maintenance

templates developed by NPP engineering specialists and Care of Assets specialists utilizing the international practice (EPRI).

The graded approach respects the categorization of equipment in setting the maintenance program in order to manage reliability and lifetime as follows:

- **Classified SSC Group A** – preventive maintenance program aimed at long-term reliability. The strategy is based on performance and state monitoring, ageing management and the implementation of preventive maintenance program with the use of developed specific/component specific ageing management programs in such cases where it is insufficient to use only standard methods of preventive maintenance and performance monitoring. This is particularly applied to the equipment with safety passive function of category 1 or category 2. This group of equipment is defined in accordance with the relevant control documentation.
- **SSC category 1** – preventive maintenance program aimed at high reliability and failure elimination 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 2** – preventive maintenance program aimed at prevention of undesired failures (safety consequences for personnel, the environment, high financial losses) with the use of standard methods of preventive maintenance. Ageing/reliability management on the basis of monitoring of the state with the use of standard methods of preventive maintenance.
- **SSC category 3** – ageing management program and no reliability program are set; the 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 the licensee and approved by the SÚJB. Components important for nuclear and technical safety are included into the inspection program; selection of these components is given by design. The inspection program is based on the design and is part of the accompanying technical documentation and quality assurance programs for each individual component. The results of in-service inspections are regularly evaluated and based on this evaluation, taking into account 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 preventive maintenance program.

Various methods are used for the inspection purposes, mainly the following: visual inspection, fluorescent penetrant inspection, magnetic powder, eddy currents, ultrasound transmission, ultrasonic thickness measurement, dimension measurement, tightness and pressure tests. The range and number of methods used and also the frequency of their application depend on the particular component's importance. NDT methods on safety-relevant components are qualified with the use of the ENIQ ("European Network for Inspection Qualification") methodology.

Inspections in difficult to access places or in places with higher radiation exposure are carried out by automated (manipulators and robots) methods. These are usually carried out by maintenance suppliers, mostly manufacturers of the monitored equipment or specialized companies with the required qualification. An accredited Inspection Body of "B" type was established within the Technical Safety department to strengthen the independence and quality of supervision.

7. **Continuous monitoring and evaluation of performance and state** – SSC performance and state monitoring is used to evaluate the SSC state and reliability/lifetime and includes:

   Operational monitoring - ensured by the operations divisions according to the relevant operating and control documentation.

   Performance and state evaluation - ensured by the Equipment Maintenance Departments and Technical Support Departments with the use of data acquired from operational monitoring, from preventive maintenance (including the results of the inspections according to the in-service inspections program and revisions according to the Rules of Revision), from the results of the Ageing Management Programs, and from internal and external feedback evaluation. The evaluation is carried out on the basis of defined parameters and criteria.

   Enhancement of SSC reliability - On the basis of performance and state evaluation, and the results of the care of assets programs, the non-conformities 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 SSC.

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

8. **Periodic evaluation of SSC state (Health Report)** – SSC performance and state are monitored on the basis of reliability-related parameters (readiness, availability, reliability/susceptibility to failures), or state (specific indicators for state monitoring), and they are subject to periodic evaluation.

9. **Integration of ageing management into the process of the Care of Assets** – activities linked to classified SSC (Group A) ageing management and ageing-related problems finding are integrated into the process of the Care of Assets and are ensured by an specific department including implementation of Ageing Management Programs. (see point 5).

10. **Monitoring and recording of SSC risks** – in the form of the Health Report of Power Plant (ZSE).

14.2.3 Ageing management and long-term operation (LTO)

As mentioned in point 9 in previous Chapter, ageing management is integrated into the process of the Care of Assets.

The Ageing Management Program has been applied at the Dukovany NPP and the Temelín NPP since the beginning of operation.

In view of the fact that Dukovany NPP (Unit 1) has already achieved its life originally set by the original design and further that ČEZ, a. s., declared a strategic objective for its NPPs to stretch out the life span for NPP by 20 to 30 years as a minimum, the work was commenced in order to implement a Long Term Operation program in accordance with global best practice. Therefore, ČEZ, a. s., took part in the IAEA program called the Safety Aspects of Long Term Operation and is also involved in the program called the International Generic Ageing Lessons Learned (IGALL).

The ageing management of SSCs includes three basic actions:

1. Screening the SSCs of NPP that should be subject to ageing assessment.
2. Understanding dominant ageing impacts/mechanisms of SSC selected with the use of the screening process under previous point and finding or developing effective and usable methods for monitoring and mitigating their ageing effects.

3. Ageing degradation management of classified SSCs caused by ageing by implementing effective measures in the field of in-service inspections, maintenance and operations control.

Ageing monitoring and assessment are ensured for:

Specific SSCs of Group A

In line with the defined component specific ageing management program, the outcome assessing SSC ageing is included in the so-called Periodic Life Assessment. The programs are developed according to the methodology ČEZ_ME_0865. The following SSCs are involved:

(i) Safety-relevant

- Perform the function of ensuring the integrity of the reactor coolant pressure boundary - this concerns passive equipment in the primary circuit pressure boundary (pursuant to SÚJB Decree No. 132/2008 Coll., classified under safety class 1 as well as classified equipment specifically designed pursuant to SÚJB Decree No. 309/2005 Coll.),
- Perform the function of ensuring the integrity of the containment and the function of prevention of leaks from containment - this concerns pressure equipment constituting structural members of the containment designed to internal overpressure, included in safety class 2, including equipment providing its leak tightness during maximum design basis accident (pursuant to Section 3(1) d) of SÚJB Decree No. 309/2005 Coll.)

(ii) Crucial to maintaining power plant operation:

- This concerns difficult-to-replace SSC, for which the loss of process function results in unacceptable losses in production or which is important to LTO.
- The so-called “component specific ageing management programs”, in the form of technical standard (TST) are prepared for the specific SSC mentioned above. Their list is provided below.

Criticality category 1, 2

This concerns SSC not included in Group A and for which, on the basis of the results of the Ageing Management Review (AMR) or other requirements, ageing monitoring and assessment shall be ensured in line with the defined specific Ageing Management Programs (this usually concerns SSCs, for which ageing monitoring and assessment cannot be ensured on the basis of the NPP Process Systems and Equipment Performance and State Monitoring). The programs are developed according to the methodology ČEZ_ME_0870. This methodology defines the essential requirements for the Ageing Management Programs, following the fulfilment of nine attributes arising from the SÚJB Safety Guide: BN-JB-2.1 Nuclear Power Plant Ageing Management, Revision 1, April 2015[13] and in linkage to power plant information system, in particular PassPort and its Register of Equipment.

All specific Ageing Management Programs, which are listed below, have the same structure and in addition to administrative and responsibility-related provisions, the main steps and methods of achieving the goal are described in the relevant methodology:

- Method of ageing prevention or mitigation,
- Method of the detection of ageing effects,
- Monitored/tested parameters and the method of their monitoring,
- Method of trend monitoring and evaluation,
- Acceptance criteria,

[13] https://www.sujb.cz/fileadmin/sujb/docs/dokumenty/publikace/BN_JB_2.1_rev1_duben2015.pdf

- Corrective measures,
- Method of acknowledgement of the activities done,
- Feedback method,
- Efficiency evaluation,
- Performance evaluation,
- Requirements for personnel qualification,
- Instrumentation requirements.

Safety-relevant, selected pursuant to SÚJB Decree No. 132/2008 Coll.

This concerns SSCs, for which there is a documentation binding upon their operation limiting their lifetime (PTD_{TLL}), or contains time limited ageing assumptions. Identification and revalidation of time limited ageing analyses (TLAA) follow the methodology ČEZ ME 0992.

Between 2012 and 2015, specific Ageing Management Programs were gradually prepared for potential degradation mechanisms, which may be present on NPP systems, structures and components, and which are in the scope of LTO.

Their purpose is:

- To define the main principles for proper setting and implementation of the given program,
- To describe the basic steps needed for providing information about the state of equipment or its/their parts or effects of the degradation mechanism under assessment,
- To allow, on the basis of evaluation of Ageing Management Programs results, the mitigation of ageing impacts by implementing early measures,
- On the basis of parameter evaluation, to give the statement for the needs of life management.

List of currently valid specific Ageing Management Programs (specific AMP):

- Ageing Management Program for Low-Cycle Fatigue – Mechanical Components Passive,
- Ageing Management Program for Erosion Corrosion - NPP Secondary Circuit Piping,
- Ageing Management Program for Reactor Pressure Vessels in NPP,
- Ageing Management Program – Safety Cables in NPP,
- Ageing Management Program for Visual Inspections - NPP Cables,
- Ageing Management Program - Settlement Measuring of Civil Structures,
- Ageing Management Program for Storage Pools,
- Ageing Management Program for Containments in Dukovany NPP,
- Ageing Management Program for Construction and Technical Surveys of Civil Structures,
- Ageing Management Program for Oil-type Power Transformer – Solution to Impacts and Prevention of the Effects of Corrosive Sulphur in Oil Filling of Power Transformers,
- Ageing Management Program for Oil-type Power Transformer – Diagnostics of Insulating and Qualitative Parameters of Insulating Oil,

- Ageing Management Program for Visual Inspection of HV Rotating Electric Machines,
- Ageing Management Program for Diagnostics of Ozone Detection in Coolant of HV Rotating Electric Machines,
- Ageing Management Program for Noise Diagnostics of HV Rotating Electric Machines,
- Ageing Management Program for Vibrational Diagnostics of Rotating Machinery,
- Ageing Management Program for Stator Magnetization Test of HV Rotating Electric Machines,
- Ageing Management Program for Oil-type Power Transformer – Electrical Measurements on Winding Insulation System and Grommets with Measured Lead,
- Ageing Management Program for Oil-type Power Transformer –Degradation of Solid Insulation in Transformer,
- Ageing Management Program for Oil-type Power Transformer – Dissolved Gas Analysis (DGA),
- Ageing Management Program for Electric Quantity Diagnostics of HV Rotating Electric Machines,
- Ageing Management Program for Inspection of Deformations of Foundation-TG System,
- Ageing Management Program for Dynamic Testing of TG Foundations,
- Ageing Management Program for Areas at Risk with Weld Joints in NPP,
- Ageing Management Program for Material Diagnostics of Steam Turbines,
- Ageing Management Program for Alternator Rotor Rings,
- Ageing Management Program for Valves with Drives – Ageing Assessment Methods,
- Ageing Management Program for Monitoring of Dukovany NPP Structures
- Ageing Management Program for Monitoring of the State of Dukovany NPP Structures.

List of component specific Ageing Management Programs:

- Component Specific Ageing Management Program for Reactor Coolant Pump,
- Component Specific Ageing Management Program for Pressurizer,
- Component Specific Ageing Management Program Management Program for Containments and Hermetic Areas of Dukovany NPP and Temelín NPP,
- Component Specific Ageing Management Program Program for Steam Generator,
- Component Specific Ageing Management Program for Main Isolating Valve,
- Component Specific Ageing Management Program for Pipelines and Pipe sections of safety class 1,
- Component Specific Ageing Management Program for Safety-Relevant Cables of NPP,
- Component Specific Ageing Management Program for Cooling Towers,
- Component Specific Ageing Management Program for Fuel Storage and Refuelling Pools (BSVP),
- Component Specific Ageing Management Program for reactor,
- Component Specific Ageing Management Program for Boundary Valves of safety class 1 at NPP,
- Component Specific Ageing Management Program - Oil-type Generator Power Transformer,

- Component Specific Ageing Management Program – Generators,
- Component Specific Ageing Management Program for turbine,
- Component Specific Ageing Management Program for High Energy Lines at ČEZ NPPs.

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 for LTO. It was prepared in the framework of operation extension of Dukovany NPP Units 1 to 4 and submitted with the application for the licence for operation of Dukovany NPP Unit 1 to the SÚJB in September 2015.

The company ČEZ, a. s., consulted the requirements concerning the Evidence of Readiness and its content with the SÚJB on a continuous basis. Preparation of LTO and Evidence of Readiness are ensured by the LTO Program, which consists of the project part and of the management systems carried out in line under responsibility of the competent directors of divisions. The Program Manager is responsible for program management. Sponsor of the program provides for the conditions for program implementation within the company ČEZ, a. s., i.e. financial and human resources for implementation, and the Management Committee controls work and approves changes and documentation. Each of the projects is 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** – reviews the outputs and proposes the feedback to the Management Committee and the Program Manager.

14.2.5 Regulatory practice

Regulatory practice to be performed by the SÚJB is defined in Section 39 of the Atomic Act, as well as in Act No. 255/2012 Coll., on Inspection (Inspection Code). The verification of a nuclear and technical safety status by the SÚJB is based particularly on its inspection activities. Section 39 of the Atomic Act establishes authority for the SÚJB inspectors to carry out inspection activities. Section 40 establishes authority of the inspectors to require that remedial measures are adopted within established deadlines, impose corrective measures, inspections, tests and reviews, including the right to propose fines. Moreover, in agreement with Section 40, the SÚJB is authorized, in the event of hazard arising from delay or occurrence of undesirable situation with impact on nuclear safety, to issue a provisional measure imposing the obligation to reduce the power output or even to suspend operation of the nuclear installation. For more legislative details see Chapter 7.

Nuclear and technical safety is evaluated and inspected through:

- the inspection activities aimed at observation of the Atomic Act and its implementing regulations,
- the so-called “licensing” procedures (to issue licences for particular practices),
- the approvals of documentation as defined by the Atomic Act.

Essentially, there are different forms of inspection activities performed by the SÚJB:

- routine inspections,
- planned specialized inspections,
- inspections responding to a particular situation (the so-called "ad-hoc" inspections).

The routine inspections are planned to cover all regular important activities performed by the licensee, especially in respect to compliance with the Limits and Conditions for safe operation. This plan is developed based on the plans for operation, requirements of Limits and Conditions and requirements in the operating procedures; the inspections are performed on daily, weekly and quarterly basis. Results of the routine inspections are usually evaluated once a month. The evaluation activity is documented in monthly reports and discussed with the licensee. In case of the planned specialized inspections a regular annual plan is developed based on:

- evaluated results of the inspections performed during a previous period,
- plan of the nuclear installation operation,
- evaluation and conclusions of routine inspections,
- conclusions of the SÚJB assessment effort,
- independent analyses, findings from safety analyses.

The inspections are usually carried out by a team of inspectors, made up of resident inspectors and inspectors from the Central Office. The so-called "ad-hoc" inspections are performed to examine events and failures with impact on nuclear safety, as well as to clarify serious findings from the routine or planned inspections.

The SÚJB assesses the level of nuclear safety also in the course of the so-called "licensing" procedure to issue licences for activities identified in the Atomic Act and implementing decrees and guidelines, and with regard to international practice. Moreover, the SÚJB assesses the level of nuclear safety assurance within the following activities:

- assessment of the periodically submitted Final Safety Analysis Report (requirements for its submittal are specified in the respective SÚJB resolution),
- evaluation of the in-service inspections program,
- evaluation of the program for the enhancement of nuclear installations safety,
- evaluation of feedback from the operational experience and implementation of the latest scientific knowledge and technology.

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

14.3 Practical examples – operational events

Welds in the Dukovany NPP

Dukovany NPP operation in the reference period was significantly influenced by the identification of weaknesses in in-service inspections of certain groups of welded joints on nuclear safety-relevant systems. Weaknesses were particularly demonstrated by finding errors in the documentation, which shall demonstrate the quality of the welded joints. However, defective welded joints were found by later inspections. The seriousness of the whole situation underlines, inter alia, the systematic misconduct in the in-service inspections of welded joints carried out by supplier.

The situation has finally led to extraordinary shutdown of Dukovany NPP Unit 2 and Dukovany NPP Unit 3, and to significant extension of the outage of Dukovany NPP Unit 1. The objective of outages was to carry out an extra inspection for all of the welded joints concerned and make any corrections where indications of potential defects were identified. The operator also launched the analysis of its organizational structure and activities carried out by suppliers in order to prepare and implement the necessary organizational measures. They shall generally improve work carried out by suppliers including specific measures in the area of in-service inspections of welded joints.

In connection with the findings of systematic misconduct in the inspections of selected welded joints at the Dukovany NPP, the Director of Temelín NPP decided to carry out inspections for 30 selected welded joints of different diameters at the Temelín NPP. No defects were found on these welds. Due to findings from the inspections of welded joints at the Dukovany NPP, 572 welded joints were verified in next step at the Temelín NPP. The in-depth review of the performance, evaluation and demonstration of the quality of welds has finally revealed weaknesses even here and a general systematic inspection was therefore ordered. A team of specialists was set up to execute an algorithm for the selection of welded joints, evaluation of radiographs and expert assessment, and decide on the acceptability of further operation of particular units.

The whole issue is analysed in Annex 4.

Loss of primary coolant in secondary circuit on Temelín NPP Unit 2

From the perspective of SÚJB, the significant event at the Temelín NPP in 2015 was the loss of primary coolant in secondary circuit on Temelín NPP Unit 2, which occurred during preparation for putting the unit back into operation after planned refuelling outage. On 26 June 2015, in heating up the unit before the initiation of approach to criticality, a difference was found between primary coolant charging and letdown in the volume of approximately 2 m^3/hour. It was found that the loss of primary coolant in the secondary circuit through SG No. 4 was the cause. The concentration of boric acid in the blowdown system was measured approximately 1.85 g/kg and the summary activity 18,650 Bq/litre. Unit cooldown through the auxiliary condenser, replacement of damaged SG primary collector bleeding pipe and flushing of all SGs were started. Condensate from the secondary circuit was cleaned on condensate demineralizer filters and drained through the neutralization tank into the radioactive drain sump tank.

Immediately after detection of increased activity level in the secondary circuit, detailed radiation situation monitoring of the working areas took place. Slightly increased dose rate of 0.25 μSv/hour was measured in a certain area in the turbine hall. Some precautionary measures were adopted as a temporary restricted access to the turbine hall and selected workers were subject to measurement of internal contamination, which was not confirmed for any of them. In the framework of the monitoring of other areas, measurable surface activity up to maximum value of 6 Bq/cm^2 was also detected in certain places on the roof of unit enclosed space in the surrounding of the outfall of the steam dump to atmosphere. In terms of radiation protection, the event had no impact on the vicinity of the NPP and was characterized as an extraordinary event of degree one.

The preliminary analysis of the event resulted in the requirement for preventive inspection on SG primary collector bleeding pipes for all SGs on Temelín NPP Unit 2, including material analyses. On the basis of the analyses, inappropriate material composition and low pipe wall thickness were determined as one of the root causes of the event. In addition, the introduced system for checking the state of bleeding pipe was not adequate, it failed to detect a deterioration of equipment. After outage, the unit was put into operation after replacement of the critical parts of SG primary collector bleeding pipes. Additional periodic inspections of the state of the pipes were proposed and their modification is under preparation. The event was rated by the operator INES Level 1.

14.4 Practical examples – new implementations and in-service inspections

New ultimate heat sink at the Dukovany NPP

In December 2015, completed were construction, testing and approval for use of the new ultimate heat sink for Dukovany Unit 1. Operation of the ultimate heat sink will be ensured by new forced-draught cooling tower system, which should replace, in future, the used cooling towers of ITERSON type. It is the essential part of the reactor unit after cooling system. Construction of the ultimate heat sink for Dukovany NPP Unit 2 will continue in this year.

Containment integrity test on Dukovany NPP Unit 1

Between 15 and 18 December 2015, the verification integrity test of containment of Dukovany NPP 1 took place in the presence of SÚJB inspection team. The purpose of this test was to verify validity of the Limits and Conditions for safe operation and fulfilment of the requirements imposed on in-service inspections, verification of the extrapolation coefficient of overpressure between 50 and 150 kPa, integrity verification of the structure as a whole and non-exceeding of design limits of deflections of the most exposed point on the structure during maximum design basis accident, and verification of the mathematical model. All objectives were successfully achieved during the test and during its subsequent evaluation.

The actual test at overpressure level of 130 kPa demonstrated not only mechanical resistance and stability of the structure forming the in-containment area, but also strength and tightness of the technology and technological equipment associated with the structure of the containment. The results of the test were part of the documentation of installation state and readiness in the administrative procedure for the licence for further long-term operation of the Dukovany NPP Unit 1.

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 operational 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 Summary of legislation relating to radiation protection

Radiation protection in Czech nuclear installations is regulated by the Atomic Act and its implementing SÚJB Decree No. 307/2002 Coll., on radiation protection, as amended by SÚJB Decree No. 499/2005 Coll., and SÚJB Decree No. 389/2012 Coll.

The legislation in the radiation protection area is consistently based on internationally recognized radiation protection principles which observe recommendations of renowned international non-governmental expert organizations and especially recommendations issued by the International Commission on Radiological Protection (ICRP), as well as on related international fundamental standards for radiation protection approved by international organizations, including the International Atomic Energy Agency.

At present, revision of Czech legislation in the field of radiation protection is currently taking place in accordance with the Recommendation No. 103 ICRP (2007), IAEA safety standards in radiation protection and Council Directive 2013/59/EURATOM.

The Atomic Act sets out a system for protection of persons and the environment from undesirable effects of ionizing radiation. Basic obligations in utilization of nuclear energy and ionizing radiation and conditions for performance of practices related to nuclear energy utilization and radiation practices are regulated in Section 4 of the Atomic Act. It concerns particularly the general obligation:

- to ensure that nuclear energy utilization or performance of radiation practices or performance of interventions to reduce exposure due to radiation incidents are justified by the benefits outweighing the risks arising or is liable to arise from these activities (justification principle),
- to maintain, in nuclear energy utilization or performance of radiation practices or performance of interventions to reduce exposure due to radiation incidents, a level of radiation protection such that the risk to human life and health and to the environment shall be kept as low as reasonably achievable, economic and social factors being taken into account (optimisation principle, “As Low As Reasonably Achievable” – ALARA principle),
- to reduce exposure of persons in performance of radiation practices, including nuclear energy utilization, so that the total exposure caused by a possible combination of exposure from all radiation practices does not exceed as a total the exposure limits specified by the implementing regulation (dose limitation principle),
- to reduce exposure of intervening individuals in case of radiation accident so as not to exceed ten times the limits laid down for exposed workers, unless it is a matter of saving human lives or preventing the development of radiation accident, potentially causing extensive social and economic consequences,
- to perform an intervention aimed at averting or reducing an exposure during radiation incident always if the expected exposure approaches or without the intervention could approach levels at which acute damage to health is caused, or if benefits outweighing detriments could be expected from such measures.

The Atomic Act establishes the obligation to obtain a licence from the SÚJB for practices listed in Section 9 (siting, construction, individual stages of commissioning, etc.). For more details see Chapter 7.2. The same applies for the release of radionuclides into the environment and for radioactive waste management. A number of additional obligations for the licensee are established in Sections 17 – 19 of the Atomic Act. In respect to the radiation protection at nuclear installations the obligations include in particular:

- to assure radiation protection in the scope required by the particular licences and to assure systematic supervisions of compliance with radiation protection requirements,
- to comply with the conditions specified in the licence issued by the SÚJB, to proceed in accordance with approved documentation and to promptly investigate any violation of such conditions or procedures, and to adopt corrective measures to prevent the situation occurring again, including the obligation to promptly report all cases where any exposure limit has been exceeded to the SÚJB,
- to comply with the technical and organizational conditions for the safe operation of nuclear installations as laid down in the implementing decrees,
- to participate in the operating of the National Radiation Monitoring Network to the extent established in a government order,
- to promptly report to the SÚJB any change or event important from the radiation protection point of view, as well as any change in circumstances decisive for issuance of the licence,
- to provide the general public with information on nuclear safety and radiation protection assurance,
- to monitor, measure, evaluate, verify and record all values, parameters and facts important from the radiation protection point of view, in the scope established in the implementing regulations, including results of the monitoring of individuals, the workplace and its vicinity, to keep and file records on the mentioned facts and to submit the recorded information to the SÚJB in a manner specified in the implementing regulation,
- to minimize the produced quantity of radioactive wastes and spent nuclear fuel to the necessary level,
- to prepare and hand over to SÚRAO data on short-term and long-term production of radioactive waste, spent nuclear fuel, and other information necessary to determine the amount and method of payments to the nuclear account,
- to keep records about radioactive waste by type of waste, in such a manner that all characteristics affecting its safe management are apparent,
- to ensure periodic medical examinations for all category A workers,
- to provide a system of training and verification of competence of personnel in accordance with the importance of the work they perform.

The Atomic Act also establishes the rights and obligations with respect to radioactive waste management. Depending on a level of contamination the Atomic Act basically distinguishes three categories of radioactive waste:

- waste which satisfy the generic clearance levels stipulated by Section 57 of SÚJB Decree No. 307/2002 Coll., and which may be discharged into the environment without the permit issued by the SÚJB,

- waste exceeding these clearance levels, and which may be discharged into the environment following a relevant administrative procedure, based on a license issued by the SÚJB, and in a manner and under conditions specified therein,
- waste highly contaminated with radionuclides, requiring a long-term isolation from the environment and disposal in a radioactive waste repository. The disposal of radioactive wastes is entrusted by law to the state organisation - SÚRAO.

The basic decree for the implementation of the Atomic Act in the field of radiation protection is SÚJB Decree No. 307/2002 Coll., on radiation protection, as amended by SÚJB Decree No. 499/2005 Coll., and SÚJB Decree No. 389/2012 Coll. The decree specifies details of the manner and extent of the assurance of the protection of individuals and environment against adverse effects of ionizing radiation during radiation practices as well as during the preparation for and actual performance of actions to reduce the continuing exposure; the regulation is thereby used for the implementation of the majority of authorizations established in the Atomic Act in respect to the radiation protection.

Among other things, SÚJB Decree No. 307/2002 Coll., quantifies, which materials and objects are considered radionuclide sources, i.e. which things and objects are subject to regulation and, on the other hand, which may be exempted from the regulation. The decree establishes the criteria for ionizing radiation sources classification into 5 categories: insignificant, minor, simple, significant and very significant sources (from Section 4 to Section 10), the criteria for categorization of workplaces, where the radiation activities are performed, into workplaces of categories I to IV (from Section 11 to Section 15), and the criteria for categorization of exposed workers into categories A and B (Section 16). The decree also defines the procedures and criteria related to the radiation protection optimization (Section 17) and introduces values of dose limits (form Section 18 to Section 23).

SÚJB Decree No. 307/2002 Coll. also governs the details of methods and the scope of radiation protection provision in the course of radiation practices and in the course of actions to reduce exposure from radiation incident, and it particularly:

- establishes the scope and manner of handling the ionizing sources requiring licence, and the requirements for radiation protection provision for the individual types of handling,
- governs the details of radioactive waste management and the release of radionuclides into the environment,
- establishes technical and organizational conditions of safe operation of ionizing radiation sources and workplaces with such sources, including details about the controlled area definition and the categorization of workplaces with sources of ionizing radiation,
- defines values, parameters and facts important from the radiation protection point of view, establishes the scope of their monitoring, measuring, evaluation, verification, recording, registration and method of data transmission to the SÚJB,
- establishes the guidance levels and rules for the adoption of measures to avert or reduce exposure during a radiation incident.

15.2 Implementation of radiation protection requirements

Dose limits

New regulations of 2002 harmonized the exposure limits with Council Directive 96/29/EURATOM; they are currently put in accordance with Council Directive 2013/59/EURATOM.

The most frequently used whole body dose limits are now expressed as internationally recommended values, which express the effect of exposure on the whole human organism (the effective dose). The values represent a sum of effective doses from the external exposure and committed effective doses from internal exposure in a specified period. New regulations, unlike the previous ones, establish neither limits for periods shorter than one calendar year, nor limits related to periods longer than five consecutive calendar years.

The limits for individual members of the population, i.e. persons usually exposed involuntarily and unconsciously, are lower than the limits for persons who are aware of the possible risks and are exposed voluntarily and intentionally, either while executing their professional duties or while being trained for such a profession.

The effective dose limits for occupational exposure of the personnel of categories A and B, i.e. the persons exposed to radiation in connection with the performance of radiation practices, are 100 mSv for the period of five consecutive calendar years, providing that in one calendar year the value shall not exceed 50 mSv. The operators of nuclear facilities assign for the work in their controlled areas only the exposed workers of category A. This shall be accompanied by the introduction of routine monitoring of their individual doses and recording of these individual doses for the period of at least 50 years. In exceptional cases, other persons can also work in controlled area, however only on condition that their radiation exposure does not exceed general limits. In order to monitor the exposed workers of category A or B, SÚJB Decree No. 307/2002 Coll., also establishes derived limits that are easier to monitor and expressed in immediately measurable units.

The effective dose limit for the individuals between 16 and 18 years of age, who are exposed to radiation consciously and voluntarily in the course of special training for their future profession, and who have been in a demonstrable way instructed about their potential occupational exposure and about the related risks, is 6 mSv in a single calendar year.

The general effective dose limits, i.e. limits related to all other individuals from the population, are 1 mSv for one calendar year or, under conditions laid down in the license to operate the workplaces of category III or IV, exceptionally the value of 5 mSv for the period of five consecutive calendar years.

The general limits are related to the average calculated exposure of the most exposed population group, for all expected exposure ways from all ionizing radiation sources and all radiation practices, which are to be considered (except as provided for in SÚJB Decree No. 307/2002 Coll.). Unless there is a direct basis for calculation available, it is necessary to use conservative estimates of variations of the factors affecting propagation of radionuclides or individuals in the critical group.

For an easier check of observance of the population exposure limits in the surroundings of a certain facility or workplace, the SÚJB is entitled to determine dose constraints related only to radiation exposure from this facility and used as the upper bound for optimization of radiation protection in relation to the population in the surroundings and to determine practice-specific lower limits (authorized limits) in the licence.

Conditions for discharges of radioactive substances

The discharging of liquid and airborne radioactive substances from nuclear installations is, pursuant to Section 9 of the Atomic Act, subject to the license issued by the SÚJB. More details, including the criteria necessary for the corresponding license, are established in Section 56 of SÚJB Decree No. 307/2002 Coll. In addition, the latter establishes the dose constraint for total discharges of radioactive substances from workplaces where radiation activities are performed shall be an average effective dose of 250 μSv per calendar year for the appropriate critical group of which 200 μSv shall be for discharges into the atmosphere and 50 μSv for discharges into watercourses in the case of nuclear installations. Each discharge shall be justified and optimized.

A license to discharge radionuclides into the environment is issued by the SÚJB. The authorized limits for discharges expressed in effective dose of the individual from the critical group of the population in the vicinity of NPP are established by the SÚJB for Dukovany and Temelín NPPs. These are for discharges into the atmosphere 40 µSv per calendar year for each of the nuclear power plants and for discharges into watercourses 6 µSv and 3 µSv for the Dukovany NPP and the Temelín NPP, respectively.

For discharges into the watercourse an authorization for discharge of waste water is also issued by the relevant local water management authorities. On this authorization, the SÚJB issues binding position with respect to problems related to the radioactivity of waters.

All real discharges are monitored by an extensive monitoring system consisting of measurement carried out both by the nuclear installation operators and independently by the SÚJB or through the State Institute for Radiation Protection. The measurement results provide reliable evidence that the licensed authorized limits are not exceeded. In the last 10 years, the maximum annual effective dose for an individual from the critical group of the population for discharges into the atmosphere was identically 0.05 µSv for both NPPs, and for discharges into the watercourses 2.9 µSv and 0.95 µSv, for the Dukovany NPP and the Temelín NPP, respectively.

Optimization in radiation protection

The technical and organizational requirements, guidance limits and procedures used for the demonstration of a reasonably achievable level of radiation protection are established in Section 17 of SÚJB Decree No. 307/2002 Coll. They are assessed within the licensing process and in the course of regular inspections. During optimization of radiation protection:

- the corresponding protective measures as well as collective doses of exposed workers and doses in a critical group of the population have to be assessed and compared before the commencement of each radiation practice,
- regular analysis of doses received during the radiation practice must be carried out, while considering additional measures available to assure the radiation protection and comparison with similar operated and socially acceptable activities.

The reasonably achievable level of radiation protection can be demonstrated by a procedure, which compares the costs of alternative measures for the enhancement of radiation protection (e.g. introduction of additional barriers) with the financial benefits expected from the correspondingly reduced exposure. The reasonably achievable level of radiation protection shall be considered proven and no additional measures are required if the costs are higher than the benefits. SÚJB Decree No. 307/2002 Coll., establishes the values of monetary equivalent for the reduction of collective effective doses of exposed personnel or population, scaled on the base of expected average effective dose and exposure limits relation. The decree also takes into account the possible need for the adjustment of the financial amounts.

A reasonably achievable level of radiation protection shall be also considered to sufficiently proved if an annual effective dose arising from a certain radiation practice including predictable deviations from normal operation exceeds 1 mSv for no exposed worker and exceeds 50 µSv for each individual, from population and a collective effective dose at a category IV workplace does not exceed 1 Sv.

In the last 10 years, the annual collective dose fluctuated about 600 mSv at the Dukovany NPP and was less than 300 mSv at the Temelín NPP.

Radiation situation monitoring in the vicinity of nuclear installations

An operator of a nuclear installation is legally responsible for the radiation monitoring in the installation vicinity. The monitoring shall be carried out in accordance with the monitoring program approved by the SÚJB. The monitoring program establishes the scope, frequency as well as the methods of measurement and evaluation of results and the corresponding reference levels. The monitoring at nuclear installations is currently performed, as a rule, directly by specialized departments of the operator. The SÚJB inspects the fulfilment of the nuclear installation operator's monitoring program and also performs its own independent measurements.

The dose rates in the vicinity of Dukovany NPP and Temelín NPP are continuously monitored by a teledosimetric system operated by the nuclear power plant. There is at least one monitoring point of the national early warning network independent of the nuclear installation operator close to each power plant.

The monitoring of doses due to external exposure in the vicinity of the nuclear power plants is carried out with the use of the network of thermoluminescent detectors by the radiation monitoring laboratory at the respective NPP. The measurement is independently carried out by the local network of thermoluminescent detectors of the SÚJB. Until now, none of these networks has recorded any violation of the investigation levels caused by the operation of the nuclear power plant.

Regular sampling and measurements of radionuclides activity in components of the environment in the vicinity of the NPPs are carried out by the radiation monitoring laboratories at the power plants. The SÚJB carries out independent monitoring through the SÚJB Regional Centres in Brno and in České Budějovice.

Since the nuclear installations are part of the National Radiation Monitoring Network, the regulatory bodies receive regular overviews of the measurement results. Moreover, the operator of the nuclear power plants on its own initiative publishes various information materials for the public. This field is governed by Government Decree No. 11/1999 Coll., on Emergency Planning Zone.

A number of other measurements are performed in the nuclear power plants vicinity with the objective to detect timely and assess any release of radioactive substances and to provide credible background information necessary to make decisions on the measures to protect the population. The measurements are performed within the National Radiation Monitoring Network coordinated by the SÚJB. The results of the monitoring are submitted to the government in annual reports on the radiation situation on the Czech Republic’s territory and to the public through the SÚJB website.

The function and organization of the Radiation Monitoring Network are governed by SÚJB Decree No. 319/2002 Coll., as amended by SÚJB Decree No. 27/2006 Coll. The Radiation Monitoring Network operates in two modes: the “regular” mode focuses on monitoring of the current radiation situation and on early detection of a radiation accident, and the “emergency” mode focuses on the assessment of consequences of a radiological emergency. The monitoring in regular mode is continuously carried out by the permanent elements of the Radiation Monitoring Network and in emergency mode, the monitoring involves also the emergency elements. The permanent elements of the Radiation Monitoring Network include:

- early warning network, composed of 71 continually working measuring points with the automatic transmission of the measured values to the central database,
- local network of the teledosimetric system (TDS) in the site of the nuclear power plants (27 measuring points on the perimeter of the Dukovany NPP area and 8 measuring points in the vicinity of the Dukovany NPP, 24 measuring points on the perimeter of the Temelín NPP area and 7 measuring points in the vicinity of the Temelín NPP),

- territorial network of thermoluminescent dosimeters (TLD) consisting of 185 measuring points, of which 132 measuring points are located in open air and remaining 53 measuring points in buildings,
- local TLD network with 119 measuring points in the vicinity of Dukovany NPP and Temelín NPP, of which 22 measuring points are operated by the SÚJB and others by the company ČEZ, a. s.,
- territorial network for air contamination measurements which includes 10 air-contamination measuring points, equipped with large-scale sampling equipment for aerosols; 8 of them are equipped with atmospheric fallout samplers,
- network of 10 laboratories performing the gamma-spectrometric or radiochemical analyses of the radionuclides content in the environment samples (aerosols, fallouts, food, drinking water, feedstuff, etc.),
- mobile groups and aircraft group equipped with the instrumentation measuring the dose rates in the atmosphere (volume activity) and on the ground (deposition of radionuclides).

15.3 Inspection activity

The Atomic Act entrusted the execution of the state supervision of the radiation protection in the Czech Republic to the SÚJB (see Chapters 7 and 8).

Inspections activities in radiation protection are carried out by SÚJB radiation protection inspectors, both at the Headquarters in Prague and at eight Regional Centres all over the country. The inspectors are required to prove their professional competence in the field, to have a university degree in the respective field and at least three years of professional experience. The inspectors are appointed by the SÚJB Chairperson. For more details see Chapter 8.

The inspections are carried out in accordance with standards governed by the SÚJB internal documentation, which includes the establishment of principles for the planning of inspections, their preparation, performance, evaluation and recording of results to the central database.

The inspections are carried out either by individual inspectors or by inspection groups. Where it is required to achieve a higher level of the unification of radiation protection practices all over the state (e.g. nuclear medicine workplaces, workplaces with unsealed radionuclide sources of category II and higher, radio-therapeutic workplaces, etc.), the inspections are carried out by specialized inspection groups. This inspection system is complemented by inspections carried out ad hoc for special inspections, especially at the workplaces of categories III and IV.

The inspections carried out in the field of nuclear power are evaluated in the feedback system on a regular basis with a view to achieving high standard of inspection efficiency. As for the indicators for radiation protection at nuclear installations within the countries associated within the OECD, the Czech Republic reaches the first place in the category of light-water and heavy-water reactors (see annual reports of OECD - NEA, ISOE - “Information System on Occupational Exposure”), which shows evidence of efficiency of this method of inspection activity assurance.

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 Summary of national legislation for on-site and off-site emergency preparedness

The national legislation is in compliance with the documents issued by the European Commission and with the international standards issued by the IAEA.

The legislative framework for the emergency preparedness of nuclear installations and their vicinities is in particular given by the Atomic Act, its implementing decrees and related government orders (see Chapter 7).

The provision of Section 2 of the Atomic Act defines the basic terms – emergency preparedness, radiation incident, radiation accident, radiological emergency, emergency exposure, emergency planning zone and emergency plan.

Pursuant to Section 3 of the Atomic Act, the SÚJB:

- approves on-site emergency plans and their modifications after discussion on the relations to off-site emergency plans; the approval of on-site emergency plan is one of the conditions for obtaining a licence for the commissioning of the installation and its operation,
- establishes an emergency planning zone, based on the licensee request,
- controls the activity of the National Radiation Monitoring Network and performs the activities of its head office,
- ensures the activities of the Emergency Response Centre and international information exchange on the radiation situation,
- ensures, by means of the National Radiation Monitoring Network and based on assessment of the radiation situation, the background information necessary to take decisions aimed at reducing or averting exposure in the case of a radiation accident,
- is obliged to provide the public with adequate information concerning the results of its activities, unless they are subject to state, professional or business secret, and to publish once a year a report on its activities and to submit the report to the Government of the Czech Republic and to the public.

Among other things, Section 4 of the Atomic Act establishes the principles for performance of radiation activities and limiting emergency exposure. The principles for averting or reducing exposure due to radiation accidents and exposure of people who participate in the mitigating interventions are elaborated in the implementing SÚJB Decree No. 307/2002 Coll., on radiation protection, as amended by SÚJB Decree no. 499/2005 Coll.

Within the general obligations, the provision of Section 17 of the Atomic Act establishes the obligation of a licensee to ensure emergency preparedness, including its verification, in the scope appropriate for the particular licenses, and to report to the SÚJB any change important from the emergency preparedness point of view, including changes in any facts relevant for license issuing.

The provision of Section 18 of the Atomic Act establishes, besides other obligations, the obligation of a licensee to:

- monitor, measure, evaluate, verify and record values, parameters and facts important for emergency preparedness, to the extent laid down by implementing regulations,
- keep and archive records of ionizing radiation sources, facilities, materials, activities, quantities, parameters and other facts important from the emergency preparedness point of view, and to submit the recorded data to the SÚJB in the manner laid down in an implementing regulation,
- ensure systematic supervision of observance of emergency preparedness, including its verification.

The provision of Section 19 of the Atomic Act establishes as one of the obligations of the license in the event of radiation incident, to the extent and in the manner determined by the on-site emergency plan approved by the SÚJB, to:

- notify immediately the relevant Regional Authorities, the SÚJB and other relevant bodies specified in the on-site emergency plan, of the occurrence or suspected occurrence of a radiation accident,
- ensure immediately warning the public within the emergency planning zone in case of a radiation accident,
- ensure immediately that the consequences of the radiation incident are dealt with in the premises, where his activities are performed and to take measures to protect employees and other persons from the effects of ionizing radiation,
- ensure the monitoring of exposures of employees and other persons, and prevent any release of radionuclides and ionizing radiation into the environment,
- inform relevant bodies, in particular on monitoring results, on factual and expected development of the situation, on measures taken to protect employees and the public, and on measures taken to deal with the radiation incident and also on the factual and expected exposure of people,
- control and regulate exposure of employees and other persons participating in the radiation incident mitigation within the premises where the licensee performs his activities,
- cooperate in dealing with the consequences of the radiation incident which occurred on his premises,
- participate, in case of radiation accident, in the activities of the National Radiation Monitoring Network.

In addition, the same Article also establishes the obligation of the licensee to submit to the appropriate Regional Authority and to the relevant Municipal Offices with extended competences background documents to prepare the off-site emergency plan and to co-operate with the authority in order to ensure emergency preparedness within the emergency planning zone.

The Article also establishes that a government order will lay down a financial share of the licensee in covering activities of the National Radiation Monitoring Network in providing the public within the emergency planning zone of relevant installations or workplaces with antidotes, in running a press and information campaign aimed at ensuring that the public is prepared for radiation accidents, in providing a system for the notification of the relevant bodies to the extent and in the manner established in the on-site emergency plan, in providing a warning system to inform the public living in the vicinity of the nuclear installation, as well as the obligation of the licensee to participate in the removal of the consequences of the radiation accident within the emergency planning zone.

Based on the provision of Section 46 some ministries are obliged to participate in providing for the emergency preparedness, i.e. this Article establishes that for the needs of the Radiation Monitoring Network on the Czech Republic's territory:

a) the Ministry of Finance ensures operation of specified parts of measuring points at border crossings and participates in operation of car borne monitoring groups,

b) the Ministry of Defence participates in operation of Early Warning Network, monitoring points at roadblocks and border crossings, operation of car borne monitoring groups and aircraft monitoring groups and ensures means of aerial survey,

c) the Ministry of Interior participates in operation of car borne monitoring groups,

d) the Ministry of Agriculture participates in operation of water contamination monitoring points and foodstuffs contamination measuring points,

e) the Ministry of the Environment shall provide meteorological services and participates in operation of Early Warning Network, air contamination monitoring points and water contamination monitoring points,

f) the Ministry of Interior provides notification and warning system in assurance of emergency preparedness and in its verification.

The Ministry of Health creates a system of special medical care provided by selected clinics to persons irradiated during radiation incidents.

Details and requirements for emergency preparedness in the case of extraordinary events (radiation incidents and accidents) are established in the implementing regulations related to the Atomic Act:

- ***SÚJB Decree No. 318/2002 Coll***., on details of emergency preparedness of nuclear installations and workplaces with ionizing radiation sources and on requirements on the content of on-site emergency plan and emergency rule, as amended by SÚJB Decree No. 2/2004 Coll.,
- ***SÚJB Decree No. 307/2002 Coll***., on radiation protection, as amended by SÚJB Decree No. 499/2005 Coll., and SÚJB Decree No. 389/2012 Coll.,
- ***Government Order No. 11/1999 Coll.,*** on emergency planning zone

SÚJB Decree No. 318/2002 Coll., establishes details of assuring emergency preparedness of nuclear installations, such as:

- identification of extraordinary event occurrence,

- assessment of the extraordinary events significance and their classification in three basic degrees,
- announcing an extraordinary event,
- activation of intervening persons,
- management and implementation of the intervention,
- requirements for the intervention procedures and instructions,
- requirements for the radiation situation monitoring program,
- methods to limit exposure of the employees and other persons,
- medical provision principles,
- ensuring documenting of the activities during an extraordinary event,
- submitting information on the occurrence and development of an extraordinary event to the SÚJB,
- requirements for training of employees and other persons,
- requirements for the emergency preparedness verification, including emergency exercises and tests of function of technical means, systems and devices necessary for management and implementation of the interventions,
- requirements for the contents of an on-site emergency plan,
- requirements for other documentation related to emergency preparedness.

SÚJB Decree No. 307/2002 Coll., in the provision of Section 92, stipulates general regulations for the preparation and performance of the interventions, and in the provision Section 98 through Section 100 and in Annex 8 establishes details in the manner and scope of radiation protection assurance during interventions to reduce exposure due to radiation incidents. Furthermore, the Decree establishes guidance levels for the early and recovery countermeasures.

Government Order No. 11/1999 Coll., defines for the licensee the following requirements:

- for the elaboration of a proposal for establishing an emergency planning zone for the nuclear facilities or workplaces with a significant source of ionizing radiation (in accordance with Section 17 of the Atomic Act the licensee shall submit this proposal to the SÚJB for the determination of the emergency planning zone size),
- for ensuring the activity of National Radiation Monitoring Network in the emergency planning zone,
- for the provision of the population in the emergency planning zone with antidotes,
- for ensuring the press and information campaign for the population in the emergency planning zone for the cases of radiation accidents,
- for the notification system of relevant bodies about occurrence or suspected occurrence of a radiation accident,
- for ensuring the warning system of population in the emergency planning zone.

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 some acts, as amended, establishes:

- Defines the Integrated Rescue System, establishes the units of the Integrated Rescue System and their authorities, authorities and powers 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 danger, emergency, threat to the country and war,
- In the provisions of Section 2, defines an extraordinary event, which is not identical (is broader) with the term "radiological emergency",
- 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 Related Acts (Crisis Act), as amended:

- Stipulates the powers and competencies 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 European Union 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 ionizing 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 by Decree No. 429/2003 Coll., 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.

Off-site emergency plan, which is emergency plan prepared for the emergency planning zone, is classified into:

- information section,
- operations section,
- planes 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 person 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 organization 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 resolution coordination,
c) criteria for the declaration of corresponding crisis situations, in case the off-site emergency plan does not suffice for the radiation accident resolution,
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 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) traumatological 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,

p) communication with the public and mass information media.

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 an unified warning and notification system as well as a way of providing emergency information.

Government Order No. 462/2000 Coll., as amended, 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, identification, record mode determination, handling and filing of documents and other materials containing special facts; procedure for designation of persons to contact with special facts; structure and activity and composition of the Regional Security Council, and content of activity and composition of the Municipal Security Council specified municipals, and the Regional Crisis Staff and specified municipality with extended competences, and 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.

16.2 Implementation of emergency preparedness measures, informing the public and neighbouring states

Emergency response organization

In accordance with SÚJB Decree No. 318/2002 Coll., the operator of the nuclear power plant (licensee) is obliged, in order to assure emergency preparedness, to create corresponding organizational and personal conditions so that in case of extraordinary events occurring the personnel of the nuclear power plant are ready to respond immediately to the situation and to commence preplanned activities aimed at eliminating the negative effects and consequences.

The Emergency Response Organization has been established both at the Dukovany NPP site and at the Temelín NPP site, which consists, during the early stage of extraordinary event development when it is required to provide for the activities related to the initial assessment of significance, notification of the extraordinary event, mobilization of intervening persons as well as operational management and implementation of intervention, of the continuous shift operation personnel only.

Shift Engineer

In case of extraordinary event occurrence the Shift Engineer is responsible for the management of the extraordinary event until the Shift Engineer relegates the responsibility to the mobilized Commander of Emergency response board. The Shift Engineer activities during the extraordinary event occurrence adhere to the intervention instruction, which includes all responsibilities and competences, which of the most important are: assessment of extraordinary event significance - classification, provision of a notification and warning of the NPP personnel and warning within the emergency planning zone, notification of nuclear power plant top management and relevant bodies and organizations on extraordinary event occurrence, decision on the Standby Emergency Response Organizations activation, decision on protective countermeasures for NPP personnel.

Operational MCR personnel

The MCR personnel having the basic workplace at the relevant MCR assure the control of each unit in case of an extraordinary event occurrence. In case the MCR is uninhabitable, or loss of the possibility of control of unit technology, the MCR personnel perform their activities from the ECR. Safety engineer responsible for extraordinary event management at the unit affected by an extraordinary event is transferred to support the personnel of this unit of the Dukovany NPP.

Other shift personnel

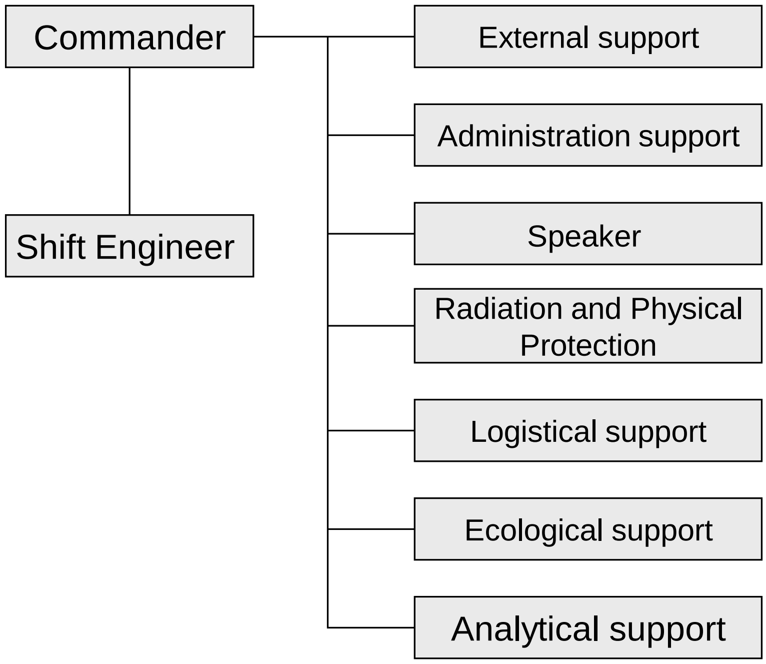
Other continuous shift operation personnel in case of an extraordinary event, depending on the significance degree, either proceeds with the activities in accordance with the instructions of the operational MCRs personnel to the extent of descriptions of its job positions, or gathers, in case of the declaration of protective countermeasures, in the operational support centre, from where, based on the instructions of the shift engineer or the Emergency Response Board, the required interventions in technology are carried out or the operative support is created to the unit of the NPP Fire Rescue Service during clearing and rescue works.

Emergency Response Board

The Emergency Response Board is the main managing workplace of the NPP emergency response organization. The Emergency Response Board secures, after its activation, the management of activities of all employees and other persons participating in intervention work when eliminating development and solving consequences of an extraordinary event at NPP. The Emergency Response Board ensures the communication with the off-site emergency preparedness units.

Main tasks of the Emergency Response Board, as a managing body, are to manage all activities in the NPP, to transfer information to superior and supervision bodies, to inform the public and to declare the protective countermeasures for NPP employees and other persons present on the NPP premises at the time of the extraordinary event occurrence. The Emergency Response Board controls the activities of the operationally established intervention groups during the liquidation of extraordinary event effects and consequences. The Emergency Response Board secures the deliveries of necessary material, special means, and alternating the personnel as well as its maintenance and supplies.

Fig. 16-1 Emergency Response Board structure

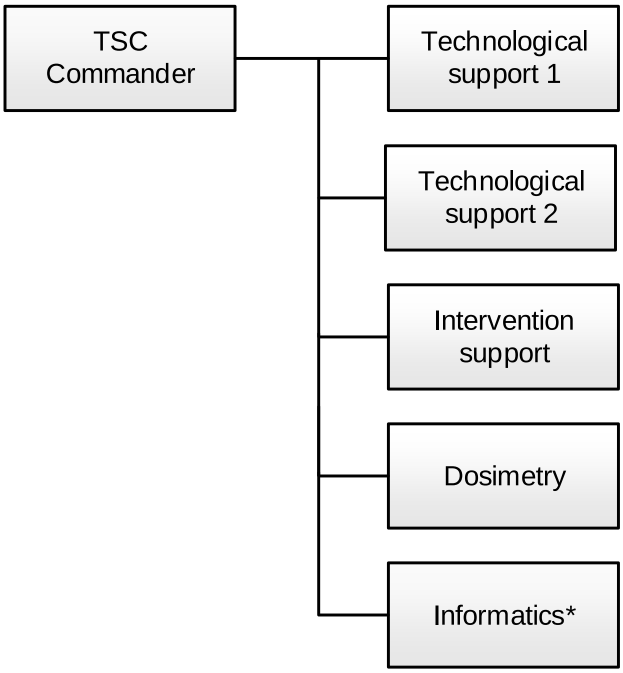


Technical Support Centre (TSC)

The Technical Support Centre personnel are made up of experts of technical departments (safety, dosimetry, operation, and informatics). The Technical Support Centre is staffed so as to be able to provide qualified technical support to the personnel of the main control room of the affected unit during extraordinary events management.

The TPC personnel also ensures immediate evaluation of nuclear power plant safety condition in consideration of nuclear safety and radiation protection; has control over the activity of operative intervention groups during management of extraordinary event consequences; and prepares basic documents and recommendations for decision-making and control activities of the Emergency Staff.

Fig. 16-2 Scheme of the organisational structure of technical support centre



*at Dukovany NPP, the Informatics function is ensured by TIS (Technological Information Systems) Operation Technician function

In the emergency preparedness system the emergency support centres represent specially prepared and equipped workplaces designed to secure the support of activities of personnel involved in the emergency response organization. Employees involved in the emergency response organization are obliged to participate in special theoretical and practical preparation aimed at acquiring activities determined by the on-site emergency plans and relevant intervention instructions. In the case of unavailability of the Emergency Control Centre on site, backup emergency control centres were completed at the Temelín NPP and the Dukovany NPP in 2014 and in 2015, respectively. The backup emergency control centre for the Dukovany NPP is set up in the Environmental Radiation Monitoring Laboratory in Moravský Krumlov and for the Temelín NPP in the Environmental Radiation Monitoring Laboratory in České Budějovice.

Classification degrees of extraordinary event

To assess significance of extraordinary events, which may occur during the performance of radiation activities on a nuclear installation, these events are classified in three basic degrees (SÚJB Decree No. 318/2002 Coll., Section 5):

- Extraordinary event of the first degree is an event which results or may result in an inadmissible exposure of employees and other persons or inadmissible release of radioactive substances into the premises of a nuclear installation or workplace. A first degree event may be a radiation incident, it has a limited and local character and may be sufficiently addressed with human and material resources available to the operating personnel or shift personnel, and no release of radioactive substances into the environment occurs during transport.

- Extraordinary event of the second degree is an event, which results or may result in inadmissible serious exposure of the employees and other persons or in inadmissible release of radioactive substances into the environment, which do not require introduction of urgent countermeasures to protect population and the environment. A second degree event may be a radiation incident requiring mobilization of licensee's intervening persons and which may be sufficiently addressed with human and material resources available to the licensee or human and material resources contracted by the licensees.
- Extraordinary event of the third degree is an event, which results or may result in an inadmissible serious release of radioactive substances into the environment, requiring introduction of urgent countermeasures to protect population and the environment, as specified in the off-site emergency plan and regional emergency plan. A third degree event is a radiation accident and in addition to mobilization of licensee's intervening persons and intervening persons under the off-site or regional emergency plans, involvement of other relevant bodies is required to address it.

National emergency preparedness and response systems

In accordance with the legal regulations, in particular in the area of crisis management, a structure of the emergency preparedness system was established in the Czech Republic for the case of crisis situations of different types. Fig. 16-3 shows the basic diagram of the structure of the emergency 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. 16-4.

Fig. 16-3 Basic diagram of the Czech Republic emergency preparedness structure for the case of an extraordinary event occurrence

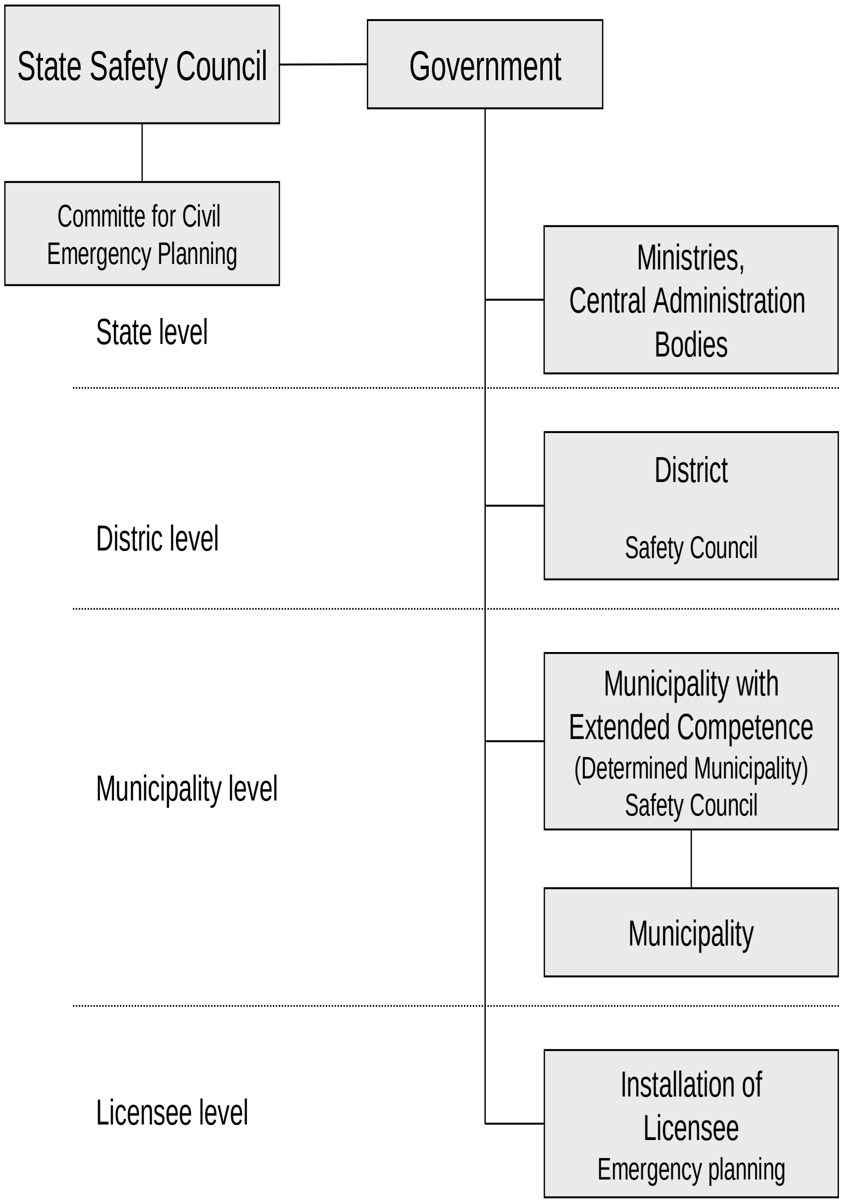
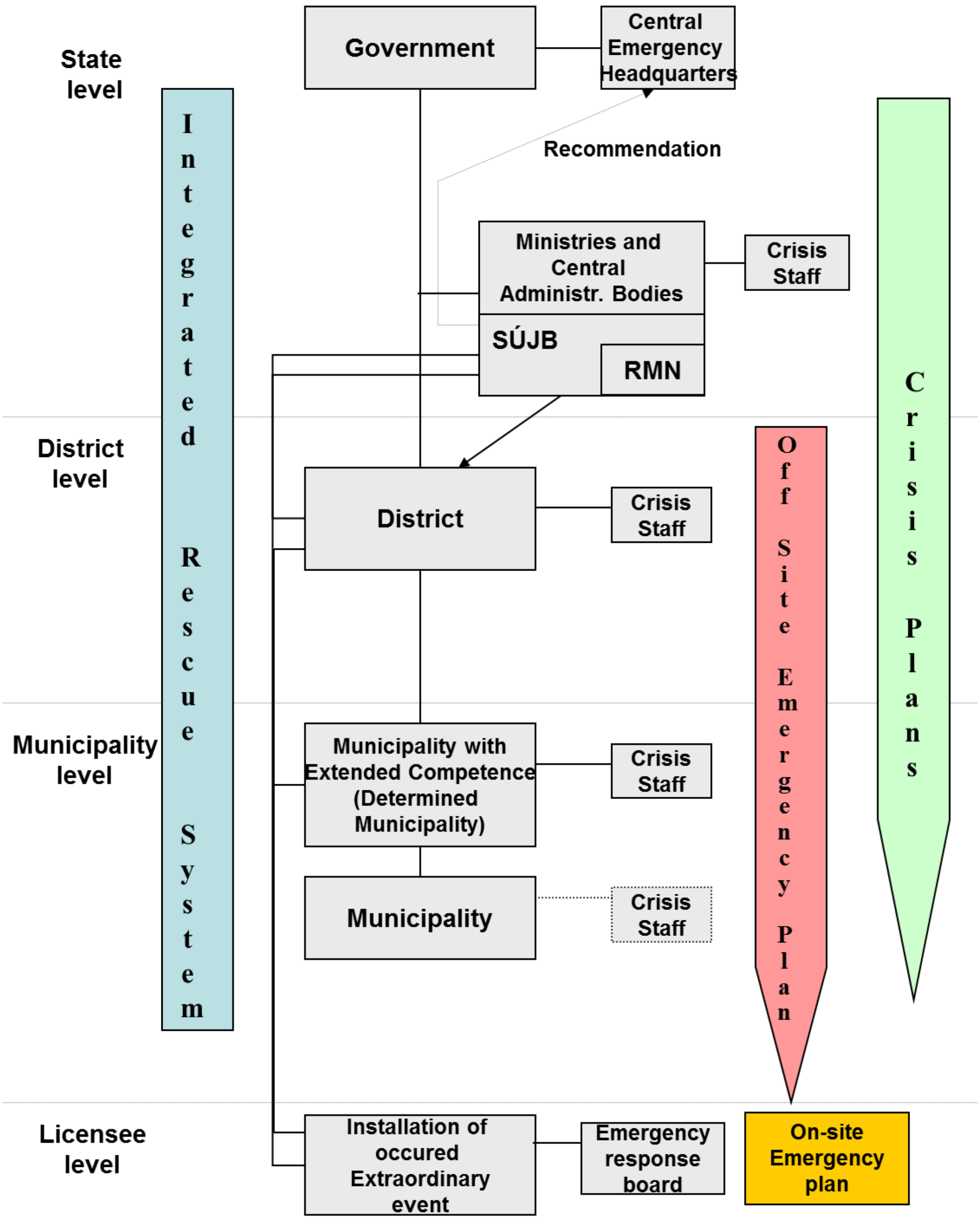


Fig. 16-4 Basic diagram of the Czech Republic emergency response structure during a radiation accident occurrence



The Czech Republic government is the highest 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 security of the Czech Republic, as amended by Constitutional Act No. 300/2000 Coll., established the National Safety Council. In linkage to this Act, the government specified the activities of the National Security Council by Czech Government Decree No. 391, of June 10, 1998 on the National Security Council and on planning of measures to secure the safety of the Czech Republic and its structure by Government Decree No. 793, of October 1, 2014 on the structure of the National Security Council. Czech Government Decree No. 391, of June 10, 1998 and Government Decree 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 emergency preparedness and emergency situation management. The activity of the National Security Council follows the statute and the rules of procedure.

The government by the above mentioned Decree No. 391 of June 10, 1998, as amended, has established a Committee for Civil Emergency Planning as a standing National Security Council working body for the coordination and planning of measures to secure the protection of national security, population and economics, critical infrastructure, to assure preventive measures to prevent use of nuclear, biological and chemical weapons including elimination of consequences of their use and to coordinate requirements on the requirements for civil resources necessary for 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 will continue to be adopted to eliminate the risk of its occurrence and reduce potential impacts, including update of the relevant safety-related documentation.

Issues in the area of planning and preparedness for the case of radiation accident occurrence come within the competence of the Civil Emergency Planning Committee (CEPC) and the areas of radiation accident solution within the competence of the Central Crisis Staff, which acts as a governmental body for the resolution of crisis situations.

The main tasks in the area of the CEPC competence are specified by the CEPC Statute and especially focused on the following:

- co-ordination of planning of the measures for assurance of protection of the population and economy, critical infrastructure including assurance of the 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 civil 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 co-ordination 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 co-ordination of activities of the representatives of the Czech Republic in the bodies of European Union, 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 safety research implementation of the Czech Republic.

The Minister of Interior is the Chairperson of the Committee for Civil Emergency Committee; 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 the State Material Reserves, the Director of the National Security Authority and the Director of the National Security Council, the Chairperson of the Council of Czech Telecommunication Office, the Police President, Chief Executive Officer of Fire and 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 the radiation accidents on a national level are addressed a working body of the government, the Central Crisis Staff is established. Depending on the nature of emergency situation, the chairman of the Central Crisis Staff is either the Minister of Interior or the Minister of Defence. The members of the Central Crisis Staff are deputy ministers and top managers of other central bodies of state administration including the SÚJB Chairperson.

The Central Crisis Staff is also 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.

On-site and off-site emergency plans of nuclear installations

On-site emergency plans of nuclear installations (licensees) are prepared in compliance with requirements for emergency preparedness assurance, and in the extent established by SÚJB Decree No. 318/2002 Coll., as amended by SÚJB Decree No. 2/2004 Coll.

The plans establish the following:

- organisational structure of the licensee and principles for management and implementation of interventions in the case of an extraordinary event occurrence. In this connection, the plans define the duties of persons and on-site organizational departments and units in case of an extraordinary event declaration, classified in accordance with their significance to the individual degrees of the classification system (refer to classification of extraordinary events),
- methods of notification of persons and units of the licensee, and other external units and bodies which have to be called in to perform an intervention within the nuclear installation (licensee) premises,
- methods of notification of the SÚJB and state administration bodies (Regional Authorities and municipalities with extended competences, to the territory of which the emergency planning zone extends) on the occurrence of an extraordinary event of 1st and 2nd degree, and in the case of an extraordinary event of 3rd degree - radiation accident - the methods of their notification and ensuring of warning of the public within the emergency planning zone,
- requirements for the radiation situation monitoring in case of extraordinary event occurrence both for the nuclear installation (licensee) premises and for its vicinity. The plans establish methods of notification and warning of the personnel and persons present in the nuclear

installation (licensee) for the particular degrees of extraordinary events, and necessary measures are specified there for the protection of their health and lives, and for the limitation and reduction of their irradiation. These plans define principles and procedures of gathering, sheltering, evacuation, providing emergency medical first aid to all employees and persons affected, including medical provision and specialized medical care,

- procedures during the termination of the extraordinary events,
- procedures for management and implementation of interventions for designated persons and departments of a nuclear installation (licensee), including security of the protection of employees and persons established by the on-site emergency plan, as well as procedures for the notification of bodies and organizations affected by the on-site emergency plan, are processed in form of intervention instructions. The latter ones specify activities after the declaration of the corresponding degree of an extraordinary event including the necessary technical, instrumental, and material assurance.

Off-site emergency plans for the nuclear installations are elaborated by the competent Fire Rescue Services of regions in accordance with the requirements specified in Act No. 239/2000 Coll., as amended, and by the Ministry of Interior Decree No. 328/2001 Coll., as amended by Decree No. 429/2003 Coll., for the specified emergency planning zone. The off-site emergency plan is developed on the basis of documents handed over by the licensee and on the basis of partial documents prepared by competent regional authorities, units and municipalities.

Developed off-site emergency plans are discussed with the licensee and with the competent central administration bodies, i.e. with the SÚJB and the Ministry of Interior – General Directorate of Fire Rescue Service of the Czech Republic.

The off-site emergency plans set down targets and methods of ensuring the individual types of protective countermeasures:

- notification of bodies and organisations,
- warning of the population,
- sheltering of the population,
- iodine prophylaxis,
- evacuation of people, including dosimetric checks and decontamination at the exits from the endangered territory,
- regulation of persons movements within the endangered territory,
- medical care.

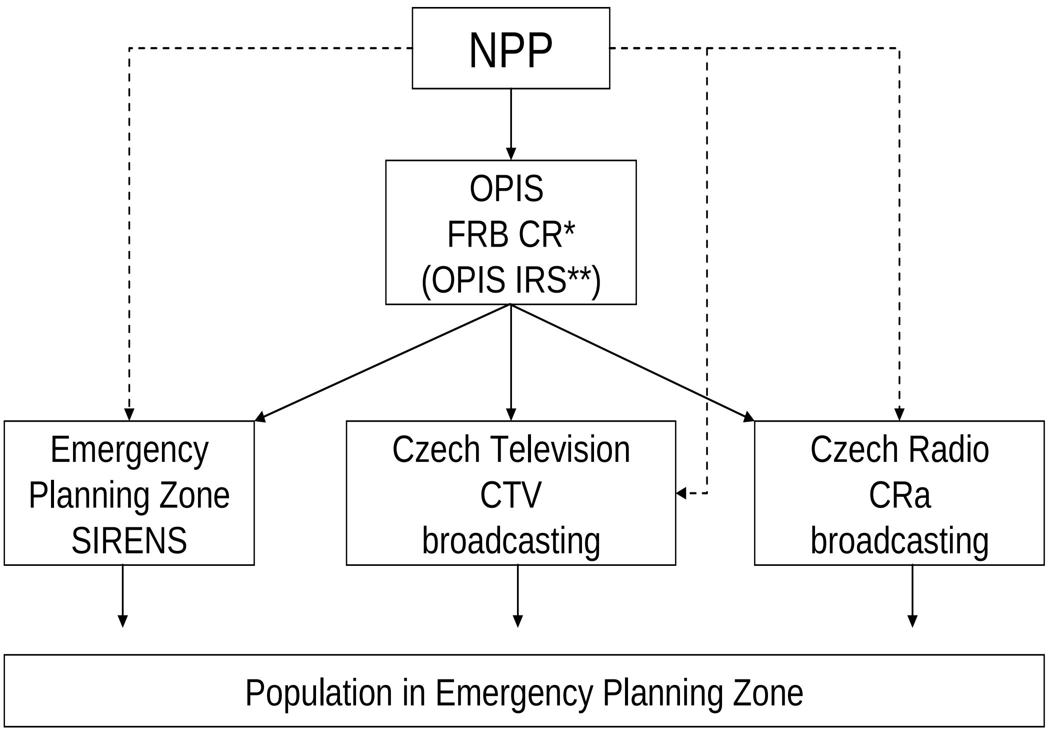
Warning of the public within the emergency planning zone

In case of occurrence of extraordinary event of the 3rd degree, for both power plants, the principal measure for protection of the population, after notification transmitted to the relevant Regional Authorities and municipalities with extended competences, is warning of the public within the emergency planning zone. Warning of the public is assured within the emergency planning zone, formed by a territory 20 km around Dukovany NPP and 13 km around Temelín NPP. The public is warned by a signal of sirens with following radio and TV broadcasting (transmissions) of the prepared initial information on the radiation accident occurrence, and on the countermeasures to be taken (sheltering, iodine prophylaxis - taking antidotes) and recommendation on the preparation for evacuation of people within 5 km internal zone around Temelín NPP and within 10 km internal zone around Dukovany NPP. Schematic representation of the public warning system within the emergency planning zone is shown in Fig. 16-5.

Iodine prophylaxis (antidotes) is distributed in advance to the population within the emergency planning zone (households, schools, hospitals, and workplaces), when the Regional Authorities have approximately 10 % reserve of KI (potassium iodide) doses, and these preparations are on sale in pharmacies. The antidotes held by the public are regularly exchanged by the licensee before their expiration date. Simultaneously the “Public Protection Manual” is distributed to the public within the emergency planning zone, which includes the basic information on activities of the public in case of radiation accident.

Fig. 16-5 Schematic representation of the public warning system within the emergency planning zone

(Solid lines indicate the basic warning system and dashed lines indicate the backup system.)



In accordance with Section 3 of the Atomic Act, the SÚJB provides, based on the evaluation of the radiation situation in the case of radiation incidents and accidents, background documents for the decision-making about measures leading to the mitigation or elimination of irradiation in case of a radiation accident. These background documents are elaborated by the SÚJB Crisis Staff based on information submitted from the affected nuclear installation and from data provided by the National Radiation Monitoring Network; the SÚJB Crisis Staff carries out its activities in the premises of the SÚJB Emergency Response Centre (KKC). In the sense of the Crisis Act, the SÚJB Emergency Response Centre is thus a crisis management workplace.

In case of an extraordinary event occurrence when using the background documents for the support of the decision making process, concerning the protective countermeasures using hardware, methodical and software tools located in the Emergency Response Centre, the Crisis Staff, among others:

- evaluates the technology status development in relation to measures implemented by the nuclear installation operators,
- evaluates the radiation situation in the nuclear installation,
- elaborates, in collaboration with the Czech Hydrometeorological Institute, the prognoses of radioactive substances dispersion from the location of radiation accident occurrence, and information about a possible threat in the nuclear installation vicinity based on the meteorological situation and its presumed development,
- specifies the "source term" of the radioactive substances release and the extent of the affected territory.

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. The SÚJB Crisis Staff in cooperation with the Operations and Information Centre of the Ministry of Interior – General Directorate of Fire Rescue Service of the Czech Republic (OPIS MV-GŘ HZS ČR) 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 (OPIS MV-GŘ HZS ČR),
- notification of the EU within the meaning of the Council Decision No. 87/600/Euratom,
- providing the public with information.

Measures for providing the public with information, including emergency preparedness in nuclear installation vicinity

Within information provided to the public within the emergency planning zones of both NPPs, the licensee prepared and the SÚJB assessed the "Manual for protection of the public in case of radiation accident of Dukovany NPP with calendar" and the "Manual for protection of the public in case of radiation accident of Temelín NPP with calendar" that are distributed to the households and public amenities in the emergency planning zone.

The manuals include the information how the public is to proceed after executed warning in the emergency planning zone in case of necessary hiding, application of iodine prophylaxis and in declaration of preparation for evacuation.

The public receives information also at the "Information Centres of the Nuclear Power Plants", and the NPPs and the SÚJB take on request of the relevant Regional Authorities part in the information campaigns organized by the Regional Authorities.

16.3 Training and exercise

Nuclear power plants have developed plans for the theoretical and practical training of their employees and other persons and units related to the occurrence of an extraordinary event of different degrees. For the persons and components determined by on-site emergency plan for management and execution of interventions, theoretical and practical preparations are organized that are focused on their activities in declaration of respective degree of extraordinary event according to the procedures of intervention determined by on-site emergency plan and their elaborated instructions for intervention. Exercises are conducted according to the annual exercise schedule.

Emergency preparedness in the emergency planning zone in accordance with the off-site emergency plan is also being verified, once in three years at a minimum, with help of exercises, in which units defined by the off-site emergency plan for the case of an extraordinary event of the 3rd degree participate.

Exercises of the off-site emergency plan for the specified emergency planning zone are organized similarly in three activity phases:

Preparatory: a scenario is elaborated for the scheduled exercise, establishing:

- goal, scope and duration of the exercise,
- determination of the model radiation accident, its development and process,
- specification of the emergency response procedures,
- specification of intervening units and hardware engagement for the emergency response,
- determination of exercise evaluators and observers.

Implementation: the proper process of the exercise according to the prepared scenario in presence of all bodies, organizations and individual persons, responsible for the management and implementation of interventions, including the activities of the persons performing the evaluation or the exercise observers and crisis management bodies of the relevant central administrative bodies,

Evaluation: elaborated in form of final protocol; protocols are filed as proof of the scheduled emergency exercise evaluation for long-term storage; for each calendar year all performed partial emergency exercises are evaluated in summary; the deficiencies, discovered during the exercise, are applied at:

- changes, modifications or detailing of the off-site emergency plan,
- amendments and modifications of emergency response intervention procedures,
- preparation of bodies, organizations and persons managing or implementing interventions during emergency response,
- amendments of hardware, equipment and material,
- amendments or modifications of organizational assurance of the emergency response.

Coordination emergency exercises of ČEZ, a. s.

The coordination of emergency exercises together with the Integrated Rescue System units and other bodies defined in the off-site emergency plans which are described in The Czech Republic National Report of 2013 continued with other exercises.

The exercise “ZONE 2013” took place at the Dukovany NPP from 26 to 28 March 2013. The latest exercise “ZONE 2015” took place at the Temelín NPP from 22 to 24 September 2015. Another exercise of this type is planned for 2017.

The exercises are conducted on the basis of the Exercise Plan of Crisis Management Bodies (Section 10(1) j) of Act No. 240/2000 Coll., on Crisis Management (Crisis Act), as amended), which sets up a medium-term outlook over a period of three years for the organization of exercises held by crisis management bodies, prepared and managed at the level of central state administration bodies and held on the territory of the Czech Republic, or with the participation of the Czech Republic. The purpose of the exercises is:

a) to verify

- timeliness and feasibility of prepared emergency documents and concluded implementation agreements,
- the system for informing the public upon the occurrence of radiation accident.

b) to practice

- the collaboration of the power plant with the units of the Integrated Rescue System according to the principles defined in the on-site and off-site emergency plan,
- the activities carried out by crisis management bodies at all levels according to the off-site emergency plan,
- the activities carried out by the emergency response organization of the Temelín NPP or the Dukovany NPP,
- the activities carried out by crisis management bodies including communication with neighbouring countries under international conventions, and communication at international level under the contracts and agreements concluded by the regions and the Fire Rescue Service of the Czech Republic,
- the activities carried out by crisis management bodies in the adoption of urgent protective measures,
- the activities of the National Radiation Monitoring Network, including aircraft monitoring group and mobile monitoring groups,
- the activities carried out by all forces and means of the components of the Integrated Rescue System, including the Armed Forces of the Czech Republic, in the performance of selected duties.

The exercises heavily contribute to improvement of readiness for radiological emergencies. Their benefit is also the verification and training of communication among individual crisis management bodies and other bodies and organizations (including foreign) involved in the crisis communication system and the possibility of examining documentation prepared for the management of extraordinary events and crisis situations. Preparation and course of each exercise are evaluated in detail and if any partial deficiencies are identified during the exercise, they are subsequently solved and reflected into the relevant documentation for radiation accident management.

In 2014, the exercise “Safeguard” took place at the Dukovany NPP, which was aimed at verifying coordination of the Emergency Response Organization of the Dukovany NPP with the Armed Forces of the Czech Republic, in the exercise of the ensuring of off-site security of the Dukovany NPP in the case of safety measures announced by the Government of the Czech Republic. The exercise verified the readiness of the Emergency Response Organization of the Dukovany NPP and the components of the Armed Forces of the Czech Republic to response and to provide extended physical security of NPP and its infrastructure in the case of external risk.

The exercise “Safeguard ETE” was held at the Temelín NPP in the course of 2015. The coordination exercise verified the ability of the Armed Forces of the Czech Republic to provide the security of the off-site perimeter of NPP in the case of external threat. The inspection of persons and vehicles during the exercise was carried out by the members of the Armed Forces of the Czech Republic. The monitoring of the restricted airspace was provided by the surface-to-air missile regiment. Coordination with the Police of the Czech Republic in tackling a simulated attack on the check-release point was verified by the Armed Forces of the Czech Republic. Aircraft go-arounds and air protection interventions were simulated in the framework of the exercise. The exercise verified the coordination of the Armed Forces of the Czech Republic, Police of the Czech Republic and Temelín NPP operator in the provision of protection of Temelín NPP as a non-military object relevant to state defence.

Further information is provided in the National Report of the Czech Republic on the Emergency Preparedness and Response, SÚJB, 2014[14] [16-1] and in the Special National Report of the Czech Republic under the Convention on Nuclear Safety, SÚJB, February 2012[15] [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 that nuclear installations have regularly verified on-site and off-site emergency plans, and which cover activities to be performed in the case of an accident. The plans, which include the activities to be carried out in case of an 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 on a regular basis.

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 installation, which may be feasibly affected by a radiation incident occurring in the nuclear installation on the territory of the Czech Republic, received the corresponding information for the preparation of emergency plans and mitigating interventions.

[14] https://www.sujb.cz/fileadmin/sujb/docs/zpravy/zprava_EPR_final_en.pdf
[15] 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 likely 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 Description of approval process, including summary of national legislation

The selection and evaluation of the territory for siting are crucial to the installation of a nuclear installation. Site suitability for the siting of a nuclear installation according to the "defence in depth" principle (IAEA Safety Fundamentals publication on Fundamental Safety Principles 3.32) is assessed from the aspect of potential external natural or anthropogenic influences and site characteristics, which could affect radionuclide migration in the environment.

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 legislative framework governing the issue of a siting permit which covers the nuclear safety and radiation protection aspects is established by the ***Atomic Act and also:***

- ***SÚJB Decree No. 215/1997 Coll.,*** on criteria for siting nuclear installations and very significant ionizing radiation sources,
- ***SÚJB Decree No. 195/1999 Coll.,*** on basic design criteria for nuclear installations with respect to nuclear safety, radiation protection and emergency preparedness,
- ***SÚJB Decree No. 132/2008 Coll.,*** on Quality Assurance System in carrying out activities connected with utilization of nuclear energy and radiation protection and on Quality assurance of selected equipment in regard to their assignment to classes of nuclear safety,
- ***SÚJB Decree No. 144/1997 Coll.,*** on physical protection of nuclear materials and nuclear installations and nuclear facilities and their classification, as amended by SÚJB Decree No. 500/2005 Coll.,
- ***Government Order No. 11/1999 Coll.,*** on emergency planning zone,
- ***SÚJB Decree No. 307/2002 Coll.,*** on radiation protection, as amended by SÚJB Decree No. 499/2005 Coll., and SÚJB Decree No. 389/2012 Coll.,
- ***SÚJB Decree No. 318/2002 Coll.,*** on details of emergency preparedness of nuclear installations and workplaces with ionizing radiation sources and on requirements on the content of on-site emergency plan and emergency rule, as amended by SÚJB Decree No. 2/2004 Coll.,
- ***SÚJB Decree No. 309/2005 Coll.,*** on assurance of technical safety of selected equipment.

As mentioned below in Chapters 7 and 8, a licence for siting of a nuclear installation is issued by the SÚJB in accordance with the provisions of Section 9 of the Atomic Act. For issuing the approval under Section 13 of the Atomic Act, the following preconditions apply:

- an environmental impact assessment pursuant to Act No. 100/2001 Coll., on Environmental Impact Assessment,
- an approval of the quality assurance program for the activity being authorized.

Application for the nuclear installation siting must be, in accordance with the Appendix A of the Atomic Act, documented by the following documentation:

I. Initial Safety Analysis Report, the content of which shall include:

- description and evidence of suitability of the selected site from the aspect of siting criteria for nuclear installations and very significant ionizing radiation sources as established in an implementing regulation,
- description and preliminary assessment of the design concept from the viewpoint of requirements laid down in an implementing regulation for nuclear safety, radiation protection and emergency preparedness,
- preliminary assessment of the nuclear installation operation impact on the personnel, the public and the environment,
- proposal of concept for safe decommissioning,
- assessment of quality assurance in the process of the selection of site, the method of quality assurance for preparatory stage of the construction and the quality assurance principles for linking stages.

II. Analysis of needs and possibilities to provide physical protection.

17.1.2 Evaluation and siting criteria for nuclear installation

Pursuant to the implementing regulations of the Atomic Act, criteria set out in SÚJB Decree No. 215/1997 Coll., and in agreement with the IAEA (in particular NS-R-3 rev. 1, 2015; SSG-9 2010, SR-85 2015; NS-G-3.4, 2003, NS-G-3.6, 2005; SSG-18, 2011) and WENRA (Safety Reference Levels for Existing Reactors: update in relation to lessons learned from Tepco Fukushima Dai-ichi accident, 2014, and Guidance Document Issue T: Natural Hazards Head Document, 2015) recommendations, a nuclear installation should be designed while taking into account the historically most significant phenomena registered in the site 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 are in compliance with the VDNS principles.

Within the siting and design, nuclear installations must be evaluated as to their resistance against the following natural phenomena, and characteristics of the area and phenomena initiated by human activity:

- seismicity,
- tectonic activity (occurrence of capable faults),
- flooding (surface water and groundwater),
- climatic conditions and occurrence of extreme meteorological phenomena (wind, snow, rain, temperatures, etc.),
- deformations of the territory surface caused by other geodynamic phenomena or mining of raw materials (landslides, liquefaction of soil, presence of karsts, post-volcanic phenomena),
- fires, air crash, and flying and falling objects,

- explosions of industrial, military and transportation means,
- releases of dangerous and explosive fluids and gases.

Based on probabilistic assessment some of these events may be excluded when the probability of their occurrence is very low. It is in the SÚJB competence to establish such limiting values for each of those cases.

Detailed instructions for assessment of the fulfilment of the criteria concerning the natural phenomena mentioned above are defined in the SÚJB Safety Guide BN-JB-1.14 “Interpretation of the Criteria for Siting Nuclear Installations and Proposal for their Evidence” [17-1] and other internal documents of the SÚJB.

SÚJB Decree No. 215/1997 Coll., contains the exclusion and conditioning criteria. Exclusion criteria are those limiting values of particular site characteristics and phenomena, which unequivocally exclude utilization of a particular region for siting nuclear installations. Conditioning criteria are such characteristics, which make an area suitable for siting nuclear installations under the condition there is a technical measure available to mitigate or eliminate the unfavourable regional conditions, both natural and the ones caused by human activities.

The criteria, which have the defined level of certain characteristics of the area or phenomenon, which exclude the siting of a nuclear installation, are related to seismicity (occurrence of the maximum magnitude), selected geodynamic phenomena (presence of karsts, volcanic and post-volcanic activity, landslides, surface deformations as a result of mining or undermining activities), tectonic activities (occurrence of a capable fault), geotechnical characteristics of subsoils (low subsoil capability, presence of liquefaction, swelling or organic soils), circulation of groundwater (presence of significant aquifers), potential flooding of the land (in the case of centennial water), impossible protection of the population, exceeding of the set average annual effective doses and interference of the area for siting in protection zones of motorways and railways. The extents of the area for analysis are defined for individual characteristics of the area.

In addition, conditioning criteria address unfavourable hydrogeological regime, aggressivity of groundwater, high rock and soil permeability, occurrence of unfavourable dispersion conditions, the possibility of occurrence of fires (for reasons of continuously forested areas and industrial hazards), existence of the protection zones (f. e. of pipelines) and potential aircraft crash.

Furthermore, Section 10 of SÚJB Decree No. 195/1999 Coll., provides an obligation for an applicant for siting a nuclear installation and its design to consider the most important natural phenomena that have been historically reported for the site and its surrounding vicinity, extrapolated with a sufficient margin for the limited accuracy (uncertainties) in values and in time, and the combination of the effects of natural phenomena or phenomena resulting from the human activities and the accident conditions caused by these phenomena.

Pursuant to Section 4 of SÚJB Decree No. 132/2008 Coll., the documentation of the quality assurance system shall be understandable, complete, uniquely identifiable, traceable and available as amended to all persons performing the relevant activities, and pursuant to Section 6(1), planning, control, verification, performance and evaluation of processes and activities within the quality assurance system shall be carried out by persons having qualification corresponding to the type and significance of the activity carried out by them. This is applicable to all professional exploratory activities, final reports and studies, which shall be physically traceable, validated and referred to in Safety Analysis Reports. Experts, who carry out site explorations, shall hold a professional competence in their respective fields.

17.1.3 Dukovany NPP

Basic data of the territory of the Dukovany NPP

The Dukovany NPP site is situated south-west of the city of Brno, on the territory of the Vysočina Region and the South-Moravian Region (see Fig. 6-1, Chapter 6). The shortest distance of the Dukovany NPP from the Austrian border is 32 km.

The terrain relief of the northern part of the site is rugged, containing the valley of the Jihlava River; in the southern part, it passes to a flatland; the altitude of the site oscillates between 210 to 595 m a. s. l.. (meters above sea level)

There are five smallish 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 north-east of the plant. Approximately 98,000 people live within 20 km of the nuclear power plant. Population density in other parts of the territory is very low, with only small settlements.

The site has been selected in a way to minimize possible interactions of the nuclear installation with the adjacent territory. Thus, in the immediate vicinity there are no large industrial facilities or frequented transport routes. 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 works.

Protection against external and internal hazards

The Dukovany NPP site is assessed from the perspective of potential external and internal natural hazards, as well as of the hazards caused by human activities from the areas of industrial production, transport and storage of hazardous substances that could, under adverse circumstances, constitute a danger to the nuclear safety of the Dukovany NPP.

For protection against all proposal events and their effects on the Dukovany NPP, 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 hazards is regularly updated, and if new external or internal hazards with impact on nuclear safety are found, an adequate project measure is proposed.

Seismicity

The Dukovany NPP site and its region is continuously monitored by the Kozének local seismic station and by the new local seismic monitoring network that was built in 2013 – 2015 and consists of five stations, namely 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 the site. The records from the above stated monitoring network are continuously evaluated by the Masaryk University of Brno – Institute of Earth Physics and the processed results are published at the publicly accessible information display[16].

The new seismic hazard assessment of the Dukovany NPP region was elaborated in 2015 in compliance with the IAEA NS-R-3 and SSG-9 standards, under use of the probability approach (PSHA - Probabilistic Seismic Hazard Assessment). The SL-2 value was expressed in compliance with the provision of the IAEA NS-G-1.6 instructions as the value of acceleration of ground vibrations that will be exceeded within 10 000 years with a 50% probability. The environment of the Moldanubian Zone

[16] http://sid.ipe.muni.cz/index.php?lang=en&id=296

of the Bohemian Massive is characterized by low seismicity; for the site of Dukovany, the SL-2 value equals to 0,047g (47 cm/s^2) [17-2], [17-3]. According to the results of danger deaggregation, 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 the site of Dukovany.

Tectonic activity, territory deformation, geodynamic phenomena

From the geological perspective, the site of the Dukovany NPP is situated in the south-eastern part of the Bohemian Massif. The regional geological unit to which near region of the power plant belongs, is the Moravian Mondanubian Zone, consisting of metamorphosed rocks (paragneisses, orthogneisses, migmatites, granulites, amphibolites, serpentinites) on which Neogene sediments (usually grevels and sands, containing also moldavites) and sedimentary covers (by fluvial and deluvial sediments, loesses and loess loams) [17-4].

The assessment of the tectonic activity of the near region and of potential occurrence of a movement-capable faults takes place continuously; the latest additional geological surveys prove that no tectonic structure meeting the definition of a potentially capable faults was identified on the power plant land and in its close environment [17-5], [17-6], [17-7], [17-8].

No occurrence of land slides is registered on the power plant near site; 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.

With respect to the bedrock consisting of hard rocks covered by eluvial sediments, no conditions for liquefaction of soil are created in the territory; no historical mining or other activities leading to subsidence or deformation of the territory surface took place here.

Floods, potential inundation

<u>Surface water</u>

The power plant site is situated in the 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, from which the technological water is taken and at the same time the waste water is discharged. Jihlava River flow at the in-flow to waterworks Dalešice varies around the average annual value of 5,4 m^3/s.

The analysis of flooding and prognostic scenarios of floods show that the power plant site, 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 VN Dalešice dam, is not endangered by inundation from the Jihlava River or by inundation 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 inundation from the heave and swinging of the water levels, effect of ice or occurrence of a tsunami shows a very low or no risk of danger [17-9], [17-10].

<u>Groundwater</u>

The groundwater on the power plant near region 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 medium is relatively low; based on pumping and recharge tests; the filtration coefficient of Neogene sediments was determined in orders of 10^{-6} to 10^{-7} m/s. A similarly low filtration coefficient was found in the fractured medium of metamorphites where the values reach in a range of 3,1 x 10^{-4} to 3,0 x 10^{-5} m/s, with prevailing values in the interval of 1,4 - 3,0 x 10^{-5} m/s [17-11].

There are no significant groundwater aquifers used for drinking water supply in the site. The immediate site and the site do not reach any protected area of natural water accumulation (CHOPAV) either.

The construction of NPP constituted a marked impact on the groundwater regime on the site where the power plant 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 is continuously drained; the drainage is implemented by a segregated sewerage system. Precipitation, sewage and industrial water is drained from the power plant. The outflow of the precipitation, sewage and industrial water 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 corrosiveness against the building structure is continuously monitored.

The nuclear power plant operates a groundwater monitoring network. The regular monitoring is evaluated in detail in regular reports. Since 2015, the existing monitoring network and its surrounding has been extended by further monitoring boreholes which will be included in the regular ground water monitoring after finishing [17-12]. The conceptual model of the flow of surface water and ground water and of the transport of substances [17-13] is continuously updated and new data from the implemented explorations are added.

Climatic situation, occurrence of extreme meteorological phenomena

Specific meteorological measurements and observations at the power plant 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 site is situated in the area of temperate climatic zone of Northern Hemisphere. According to the classification of the climatic areas of the Czech Republic [17-14], the site can be classified as a site on the boundary of warm climatic areas MT7, MT11 and MT6, based on the data measurement from 1961–2010.

The average annual temperature in the site, 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 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 standard deviation of 94 mm, and it oscillates between the values of 358 mm and 821 mm.

Extreme and exceptionally occurring meteorological phenomena are analyzed based on series measured in the meteorological observatory of the Czech hydrometeorological institute of Dukovany and in other stations with comparable meteorological conditions of the Dukovany NPP site, for example according to the [17-15] methodologies. Estimates of maximal and minimal air temperatures for the site, as well as their supposed non-exceeding until 2030, estimates of 1 s and 10 s 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 centennial, millennial and ten-millennial water value of snow (mm) have been determined [17-16]. Estimates of impacts of climatic change are considered based on the research project of ČHMÚ [17-17].

Aircraft crash

The airspace above the nuclear power plant has been proclaimed prohibited for all flights in the document "Flight Information Manual" which is binding on all users of the Czech Republic airspace.

The nuclear power plant is located in a close vicinity of military airfield Náměšť (approximately 10 km). The space above the nuclear power plant with a radius of 2 km and height of 1500 meters is a prohibited space for airplanes.

Probabilistic as well as deterministic analyses of the possibility and consequences of an aircraft crash of various categories were carried out. The analyses have shown that the power plant is sufficiently protected against the effects caused by the impact of so-called "design aircraft", model-equivalent to a civil or military aircraft. Assessment of the protection against the effects caused by an aircraft crash was performed in accordance with the IAEA instructions. The results of the calculations have shown that the aircraft crash will not cause inadmissible destruction of the primary system because its civil structures, important for nuclear safety, are sufficiently resistant against possible impacts of such a crash. The analyses have also shown that the spatially isolated backed-up core cooling systems, together with civil protective structures, ensure that even an 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, there is a second-class road (No. 15) – Brno, Ivančice, Dukovany, Jaroměřice nad Rokytnou, 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 a dangerous freight, plant safety will not be affected in any way.

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 danger. 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 equipment important for 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 in order to minimize the possibilities of hydrogen escape.

17.1.4 Temelín NPP

Basic geographic and demographic data

The Temelín NPP site is situated in the territory of the South Bohemian Region, north of the city of České Budějovice. The shortest distance of the Temelín NPP from the Austrian border is 49 km and from the German border, 59 km.

The nearest municipality to the nuclear power plant is the village Temelín with 871 inhabitants at a distance of 2 km in north-west direction. The distance of Týn nad Vltavou with 8,089 inhabitants is 4.4 km, and of the Vodňany town with 6,870 inhabitants is 14 km. The České Budějovice city is at a distance of 22 km and its population is approximately 93,250. Approximately 303,000 persons live within a radius of 30 km around the nuclear power plant, according to general census of the population in 2011. Population density in other parts of the territory is very low, with only small settlements.

The site was selected so as to minimize potential interactions of the nuclear installation with the environs - there are no big industrial facilities in immediate vicinity and the density of industrial premises is considerably lower in South Bohemia than on the remaining territory of the Czech Republic. The near region of the nuclear power plant has an unequivocally agricultural character, and there are only a few small industrial works. No industrial development in 10 km area in the perspective up to 2020 is planned.

Protection against external and internal hazards

The Temelín NPP site is assessed from the perspective of potential external and internal natural hazards, as well as of the hazards caused by human activities from the areas of industrial production, transport and storage of hazardous substances that could, under adverse circumstances, constitute a danger to the nuclear safety of the Temelín NPP.

For protection against all proposal events and their effects on the Temelín NPP, 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 hazards is regularly updated, and if new external or internal hazards with impact on nuclear safety are found, an adequate project measure is proposed.

Seismicity

The site is continuously monitored by the local seismic monitoring network in which measurement has been taking place since 1991. The network was upgraded in 2004 - 2005. This year, another technological modernization of all components of the stations will be finished. The records from the above stated monitoring network are continuously evaluated by the Masaryk University of Brno – Institute of Earth Physics and the processed results are published at the publicly accessible information display. [17].

The new seismic hazard assessment of the Temelín NPP was elaborated in 2015 in compliance with the IAEA NS-R-3 and SSG-9 standards, under use of the probability approach (PSHA - Probabilistic Seismic Hazard Assessment). The SL-2 value was expressed in compliance with the provision of the NS-G-1.6 instructions as the value of acceleration of ground vibrations 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 deaggregation of danger, the areas of Mürz Valley and Vienna Basin are the potentially most important source areas of earthquake for the Temelín NPP 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 2013, the IAEA mission - „FOLLOW-UP REVIEW MISSION ON SEISMIC HAZARD ISSUES AT TEMELIN NUCLEAR POWER PLANT SITE, CZECH REPUBLIC“ took place. There were discussing, besides other things, the methodology of determination of the value of the seismic danger.

Tectonic activity, territory deformation, geodynamic phenomena

From the geological perspective, the site of Temelín NPP is situated in the southern part of the Bohemian Massif, in a territory belonging to the Moldanubian complex. The near site of the Temelín NPP is reached by monotonous and by variegated series of the Moldanubian Zone, consisting

[17] http://sid.ipe.muni.cz/index.php?lang=en&id=296

primarily of different metamorphosed rock types (migmatites, gneisses (with occurrence of quartz, erlan granite and pegmatite dikes) covered by residues of Neogene sediments (sands, aggregates, clays) and quarternary sediments (fluvial, diluvial sediments, loess and loess clays). The site is reached by granites and syenites from the north and by sediments of the Budějovice and Třeboň basin from the south and east.

The physical and mechanical properties of the soils and other parameters of crystalline rocks on the Temelín NPP site exclude the occurrence of earth slides and plastic driving out of bedrocks or reduce considerably the susceptibility of slopes to sliding. The territory does also include no 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, whose properties could indicate susceptibility to liquefaction or swelling; mining has not taken place here, and the territory is not undermined.

Additional up-to-date geological studies show that no tectonic structure meeting the definition of capable fault has been found on the Temelín NPP site [17-18, 17-19].

Floods, potential inundation

Surface water

The Temelín NPP site is situated in the catchment areas of two watercourses, the Vltava and the Bílý potok. The Bílý potok belongs to the catchment area of the Blanice River, flowing into it between the towns of Vodňany and Protivín, in a distance of 13 km from the Temelín NPP. Two water dams were built on the Vltava River for the purpose of the Temelín NPP. They are: the Hněvkovice dam, situated at about 4 km to the west, and the Kořensko dam, situated at 6 km to the north from the Temelín NPP. The Hněvkovice dam serves as source of raw water. The Kořensko dam serves for homogenization of the sewage water discharged from the Temelín NPP. Vltava River flow at the in-flow to waterworks Hněvkovice varies around the average annual value of 27.6 m^3/s.

The analysis of flooding sources and prognostic scenarios of floods show, that the Temelín NPP, thanks to its position at an altitude by 129 m higher than the maximal possible level heights in dam Hněvkovice and dam Kořensko in case of flow of ten-millennium water, caused by a hypothetic damage to the dam Lipno dam and subsequent damage to the dam Hněvkovice dam, is not endangered by inundation from the Vltava River. The Temelín NPP is not endangered by inundation from surrounding small watercourses in case of flood at centennial water flow.

Groundwater

The groundwater on the power plant site is bound to fissure fractured rock medium of crystalline rocks of the Moldanubian Zone or to the zone of near-surface disconnection of fractures, respectively; the groundwater in wider environs is bound to porous rock medium of sediments of small residues of Neogene sediments and sediments of South Bohemian basins (Cretaceous and Cenozoic sediments).

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 surface infiltration of precipitations, and in a more permeable rock medium, 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 stream, or, to a lesser extent, Blanice in the west). In greater depths, a lower zone of slowed groundwater flow exists and is characterized by slow groundwater flow with 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 [17-20].

The near site does not collide with any protected area of natural water accumulation (CHOPAV). The closest CHOPAV are - Třeboň basin is situated to the Temelín NPP and separated from the immediate Temelín NPP site by the erosion base of the Vltava River; in view of the terrain morphology, character of the rock environment and the conditions of groundwater flow, its influencing is excluded.

The Temelín NPP land is permanently drained by a system of water-lowering wells; the land and its surroundings contain a groundwater monitoring network in which regular monitoring takes place, being evaluated in more detail in annual reports of the environmental impact of the Temelín NPP.

Climatic situation, 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 Temelín NPP for the period of 1901 to 2012, as well as on the observation of the actual station in Temelín for the period of 1989 to 2012, depending on the type of meteorological information and availability and quality of observation data.

From the macroclimatological perspective, the site is situated in the area of temperate climatic zone of Northern Hemisphere. According to the classification of the climatic areas of the Czech Republic [17-14], the site can be classified as a site on the boundary of warm climatic areas MT7, MT10 and MT11, based on the data measurement from 1961 – 2010.

The average annual temperature in the site for the period of 1876 – 2012 amounts to 8.4 °C with 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, with standard deviation of 143 mm, and oscillate between 370 and 1060 mm. The site is not limited by increased incidence of extraordinarily adverse dispersion conditions in the atmosphere.

Extreme and exceptionally occurring meteorological phenomena are analyzed 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 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 centennial, millennial and ten-millennial water value of snow (mm) and estimates of 1 s and 10 s and 10 min wind load (m/s) have been determined [17-21, 17-22]. Estimates of impacts of climatic change are considered based on the research project of ČHMÚ [17-17].

Aircraft crash, and flying and falling objects

The space above the nuclear power plant with a radius of 2 km and height of 1500 meters is a prohibited space for aircraft. This prohibition has been proclaimed according to the "Flight Information Manual". The nearest flight corridor is situated 18 km from the power plant and therefore, the air traffic has no immediate influence on the nuclear power plant. Calculations have shown that the power plant is protected against the effects caused by a design aircraft crash. The results of the calculations have shown that an aircraft crash would not cause inadmissible destruction of the primary system because its civil constructions, important for nuclear safety, are sufficiently resistant against the possible impacts of such a crash. The analyses have also shown that the spatially isolated backed-up core cooling systems, together with civil protective structures, ensure that even an 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 three branches of the transit gas line of 1400, 1000 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 was 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 also a system for natural gas leakage monitoring.

At the south-east boundary of the site is a frequented secondary road No. 105 České Budějovice – Týn nad Vltavou. Other roads in the plants 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 be not 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 long-term prospect is practically zero.

Protection against hazards of third parties

The nuclear power plant design takes into account also the protection against the hazards of third parties. Safety systems are redundant and spatially distant, the same is valid for their power supply. This engineered safety is supplemented with technical, organizational and regime system of measures, which shall prevent the inadmissible hazards of third parties.

17.1.5 Information on the 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” (NAP NE) on 3 June 2015, which follows the updated State Energy Concept (SEC) and within the limits of its strategic task (with final opinion from the environmental impact assessment process – SEA), transforms any sub-targets of this document into particular implementation steps.

The Resolution of the Czech government No. 48 from January 25, 2016 approved the statute of 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.

Specifically, as regards construction of new nuclear facilities in the territory of the Czech Republic in accordance with the strategic task defined in SEC, 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, while protecting the potential risks by obtaining the necessary permits/licences for the possibility of construction of two units at both sites. In particular, to maintain the continuation of production at the Dukovany site, the construction of a unit at the Dukovany site and its commissioning by 2037 are crucial in order to ensure the continuity of the operation of a nuclear facility and human resources at the site until 2037 when the shutdown of the existing NPP is expected.

In 2008 – 2013, the international process of Environmental Impact Assessment (EIA) took place in the Temelín NPP site and was concluded by the issue of an affirmative EIA opinion of Minister of Environment. The licensing procedure according to 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 permit to place nuclear installations of units 3 and 4 in the Temelín NPP site.

At present, ČEZ, a. s. is performing preparatory works in the Dukovany NPP site to start the process of Environmental Impact Assessment (EIA).

17.1.6 Assessment of the siting territory

The selection of the territories of the nuclear installations in operation was carried out so as to minimize external natural hazards and influences resulting from human activities on the nuclear safety, as well as the influence of the nuclear installation on the environs and on the population.

The Atomic Act imposes the obligation to observe, measure, assess, verify and record the values, parameters and facts important from the perspective of nuclear safety, radiation protection, physical protection and radiation preparedness in the scope specified by the implementing regulations and in compliance with the existing state of the science and technology all along the life cycles of the nuclear installations in operation and to ensure the use of the assessment results in practice.

SÚJB Decree No. 215/1997 Coll., requires that the impacts of the external events mentioned above should be re-evaluated for nuclear installations that are already in operation, within the framework of the regular revisions of the safety documentation, on the basis of the current technical level and knowledge while taking into account any changes which have occurred in the region.

All newly found facts and changes are regularly included in the Pre-operational safety reports submitted by the operating organization once a year.

All safety reports and their updates are evaluated by SÚJB or by its hired experts.

The Periodic Safety Review (PSR) is carried out at regular intervals (but not less than each ten years) and is described in chapters 14 and 19 additionally to further evaluations, including handling of so called "multi unit events".

17.2 Impact of the installation on individuals, society and environment

Environmental effect of Dukovany and Temelín NPPs was minimized and it is kept supervised, monitored and controlled which is proved by the introduction of EMS (Environmental management system) that was certified at Dukovany NPP in 2001 and at Temelín NPP in 2004. The certification was executed by 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. For details, refer to Chapter 16.

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, ionizing 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 for the “Program”. 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 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, v.v.i., Prague.

During construction, in accordance with 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 to this assessment.

In addition, in the frame of the Melk protocol closed 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 in accordance with 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.

Possible impact was monitored in the following areas: climate and air, hydrology, geology and seismicity, impact on the population´s health, influence on the 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 hazards during the future plant operation. The measures are continuously fulfilled and regularly assessed.

Both EIA processes were accompanied by a proper public hearing, where all questions and comments raised by the public of the Czech Republic, Austria and Germany were answered.

17.3 Re-evaluation of site related factors

Regular re-evaluation of the characteristics of the area for Dukovany NPP and Temelín NPP is carried out in the framework of PSR, which takes place at ten-year intervals – see Chapter 14. Additional evaluation took place in the framework of the stress tests performed in response to the accident at the Fukushima Daiichi NPP.

Last detailed evaluation of the Temelín NPP site was carried out in the framework of the administrative procedure for siting of new units – Temelín NPP Units 3 and 4 in 2014 and the Dukovany NPP site in the framework of the administrative procedure for further operation of Dukovany NPP Unit 1 between 2014 and 2015, which was preceded by PSR.

In addition to the criteria and requirements laid down by legislation, the SÚJB has also the possibility, which the SÚJB made use of in both cases, to impose requirements on the operator (ČEZ, a. s.) in the licence for further operation as to the future evaluations, when further operation shall be conditional on their performance.

Requirements for this continuous evaluation meet the principles arising from the VDNS.

17.4. Consultation with other Contracting Parties likely to be affected by the

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

Legislation of the Czech Republic establishes the relevant procedures for assessment of all factors important for 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 taking into account any changes, which occurred in the region. 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 (defense 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 processes that took place or are under preparation are based on IAEA requirements and recommendations such as GSR-1, SSR 2-1, SSR2-2, NS-R-3, etc. All design specifications were based on the actual requirements mentioned above, also incorporated in the EUR C Standard, which was used for the request for quote procedure. Documentation evaluation in the framework of the administrative procedure in the matter of a licence for siting of a nuclear installation on 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 laid down in IAEA SSR2-1, selected into the WENRA Reference Levels 2008, which are reflected into the safety guides issued by the SÚJB as well as the requirements of the WENRA Reference Levels for reactors in operation, issued in 2014, are applied to nuclear installations in operation.

In order to achieve safety-related objectives, formulated in the Principle 2 of VDNS, a systematic and periodic safety assessment takes place, as described in Chapters 6, 14 and 17. Equipment modifications, and enhancements and completions to the instructions for operation and for emergency management are carried out on a continuous basis, in accordance with the results of the assessment of their safety relevance. Measures, the urgency of which mostly results from the application of the principle of preliminary caution and from the needs for completition the already created levels of defence in depth on the basis of international experience, are in general currently implemented under the National Action Plan, referred to in Annex 9.

The state of fulfilment of the objectives, formulated in the Principle 3 of VDNS, is stated, in addition to this Chapter, in Chapters 6 and 7. The declared intention of the Czech Republic is to complete the modernization of nuclear legislation in 2017.

18.1 Implementation of defence in depth

18.1.1 Description of the approval process for design and construction of nuclear installation

The description of the licensing process, in general for siting, design and construction, operation and decommissioning of nuclear installation is given in Chapter 7.

As further 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, from the nuclear safety and radiation protection point of view. For issuing the nuclear installation construction license under Section 13(5) of the Atomic Act, the following preconditions apply:

- an approval of the quality assurance program for the activity being authorized,
- an approval of the quality assurance program for the design.

Application for an approval for a nuclear installation construction must be in accordance with the Appendix B of the Atomic Act documented by the following documentation:

a) Final Safety Analysis Report, the content of which shall include:

- evidence that the proposed solution, given by the design, meets all requirements for nuclear safety, laid down in implementing regulations,
- safety analyses,
- data on the presumed lifetime of the nuclear installation,
- concept of a safe termination of operation (shutdown) and decommissioning of the licensed nuclear installation, including nuclear waste disposal,
- concept of spent nuclear fuel management,
- assessment of quality assurance during preparation for construction, method of quality assurance for the carrying out of construction work and principles of quality assurance for linking phases,
- list of classified equipment.

b) Physical protection assurance proposal.

After positive assessment of the above documentation the SÚJB will issue the construction license, whilst the list of classified equipment and physical protection assurance proposal are subject to a separate approval by the SÚJB.

SÚJB inspection authority is given 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 so-called “licensing” procedures (to issue licences for particular activities),
- the approvals of documentation as 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. The Atomic Act imposes on anyone, who performs practices related to nuclear energy utilization, an obligation to proceed in such a manner that nuclear safety and radiation protection are ensured at high level as a matter of priority, and that the risk to human life, health and to the environment is as low as reasonably achievable, economic and social factors being taken into account. Section 2(2) d) of the Atomic Act defines nuclear safety as: “the condition and ability of a nuclear installation and its servicing personnel to prevent the uncontrolled development of a fission chain reaction or an inadmissible release of radioactive substances or ionising radiation into the environment, and to reduce the consequences of accidents”.

As for design of the new power plant, the practice in the Czech Republic is that the national regulatory body requires to comply with the IAEA recommendations (Fundamental Safety Principles, Safety Fundamentals SF-1, Safety of Nuclear Power Plants: Design SSR-2/1 and others), 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, WENRA recommendations RHWG Safety Reference Level, May 2014, “Safety Reference Levels for Existing Reactors” and RHWG Guidance Document Issue T: Natural Hazards (Head Document), 2015 and RHWG safety of new NPP designs Study by WENRA RHWG March 2013. The requirements were also applied in the administrative process of licence for siting of Temelín NPP Units 3 and 4, which took place between 2013 and 2014.

The new Atomic Act under preparation, which should be in force in 2017, contains the requirement for practical elimination of an early and large radiation release such that will not allow for local or time limitation of implemented emergency measures.

18.1.2 Basic nuclear safety principles included to the nuclear power plant design, including the application of the defence-in-depth strategy

Dukovany NPP

Technological description of the Dukovany NPP units is given in the Annex 1.

The safety criteria and principles on which the original design was based were included into the Russian Contract design – “Technical Substantiation of Safety”. The design criteria are here narrowed down to one basic nuclear safety criterion:

“NPP design must provide for the protection of personnel and the public from outer and inner irradiation and protection of environment from contamination by radioactive substances within approved standards. This should be assured both during long-term normal operation and 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 of series of Czech and Russian normative regulations, which were taken into account during redesign of the original technical design into the particular design of Dukovany NPP 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 failure 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. Due to low core power density and robust construction, the design is characterized by high passive safety.

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 defined and 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 design extended conditions has been included in the Final 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 conditions and methods of analysis. The list of analysed events respects the recommendations defined by WENRA and SÚJB Safety Guides.

The requirement for the application of the defence in depth principle in nuclear safety assurance by using multiple physical barriers and levels of measures to protect them is established in Section 3 of SÚJB Decree No. 195/1999 Coll., on basic design criteria for nuclear installations with respect to nuclear safety, radiation protection and emergency preparedness. This Decree also establishes the obligation to ensure basic safety functions of a nuclear installation during any realistic external natural hazards and human induces events.

The design of Dukovany NPP units respects the defence in depth concept as defined in IAEA document INSAG 10 including its update by RHWG document: Safety of New NPP Designs Study by WENRA RHWG March 2013. The concept is based on several protection levels of gradually applied physical barriers (fuel matrix, fuel cladding, pressure unit of reactor cooling primary circuit, containment), preventing radioactive substances from releasing into the environment, applied in the following order:

- Level 1: conservative design, high quality of construction and operation, management and maintenance of power plant parameters within defined operational limits,
- Level 2: control and limitation systems, safety-relevant parameters monitoring program,
- Level 3a: reactor protection system, safety systems, accident conditions management procedures,
- Level 3b: backup and alternative resources and procedures for accident management and radioactive release reduction,
- Level 4: measures to mitigate consequences related to core meltdown, severe accident management, and radioactive release reduction,
- Level 5: off-site emergency response organization by intervention levels.

Temelín NPP

Technological description of the Temelín NPP units is given in the Annex 1.

Both 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 Unit 1 and Unit 2 was elaborated by the Czech design organization Energoprojekt (EGP) Praha. 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.

Significant changes of the design are described in Chapter 6.3.2.

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 design extended conditions. Complex processes during such events and design potential to cope with the design extended conditions are analysed with the use of realistic computational tools, input conditions and methods of analysis. The list of analysed events respects the recommendations defined by IAEA, WENRA and SÚJB Safety Guides.

To reach and to maintain the required level of nuclear safety, Temelín NPP is designed to be compliant with generally applicable national and international regulations for nuclear safety assurance, and fulfils following basic safety functions in all operating modes envisaged by the design, and conditions of a nuclear installation, in particular postulating initiating events taken into account in the design so as to ensure for personnel and equipment:

- capability to safety shutdown the reactor and to maintain it in a shutdown safe condition,
- capability to remove residual heat from the reactor core and deposited irradiated nuclear fuel,
- capability to minimize any possible leakage of radioactive substances so as not to exceed the stated limits.

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. Where possible, passive safety functions are used. The requirement for the application of the defence in depth principle for nuclear safety assurance by using multiple physical barriers and their protection is established in Section 3 of SÚJB Decree No. 195/1999 Coll., on basic design criteria for nuclear installations with respect to nuclear safety, radiation protection and emergency preparedness.

Temelín NPP design respects the defence in depth concept as defined in IAEA document INSAG 10 including its update by RHWG document: Safety of New NPP Designs Study by WENRA RHWG March 2013. It is based on several protection levels, including gradual physical barriers (fuel matrix, fuel cladding, pressure unit of primary circuit, containment), preventing radioactivity from escaping into the environment.

18.1.3 Safety re-assessment

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, 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). Periodic and continuous nuclear safety level re-assessment tools will be further strengthened in the new Atomic Act under preparation, which should be in force in 2017.

Dukovany NPP

The Final Safety Analysis Report for Dukovany NPP is annually revised in order to keep the document up to date with all the incorporated changes in a nuclear installation as well as changes in safety requirements. The requirement for Periodic Safety Review (PSR) is the condition of an approval for operation and its content is defined by SÚJB Safety Guide based on the IAEA Recommendation NS-G-2.10. First periodic review took place in 2005 - 2006, and the next in 2013 - 2014. Their findings 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 continuously updated. The tools used for continuous monitoring and periodic safety re-assessment are described in detail in Chapter 14.1.2.

In PSR were identified and subsequently implemented the measures to increase the resistance of a nuclear installation to occurrence and extension severe accident conditions with fuel meltdown. Such measure enables external cooling of reactor pressure vessel with water and hydrogen removal using new systems. In addition, the building with bubbler condenser (pressure limiting device in hermetic areas of the containment 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, installed were the backup power sources for the case of loss of operating power and on-site power (station black out). 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 in the National Action Plan. I&C systems were completely replaced; sets of updated deterministic and probabilistic safety analyses were submitted, and other activities aimed at safety enhancement were conducted.

In the framework of the National Action Plan, was improved the resistance of certain civil structures to extreme climatic phenomena, such as flooding due to torrential rain.

Temelín NPP

The Final Safety Analysis Report for Temelín NPP is annually revised in order to keep the document up to date, with all the incorporated changes in a nuclear installation as well as changes in safety requirements. The requirement for Periodic Safety Review (PSR) is the condition of a licence for operation and its content is defined by SÚJB Safety Guide and is based on the IAEA Recommendation NS-G-2.10. The review took place in 2008 - 2010.

In the PSR, were identified and subsequently implemented the measures to increase design resistance to occurrence and extension severe accident conditions with fuel meltdown by installing new hydrogen removal systems with higher capacity. A changing to a new fuel with better mechanical properties took place. Furthermore, cable re-qualification was carried out. Certain parts of safety-related documentation were revised and some organizational changes were made. The possibility of direct or indirect cooling of melt nuclear fuel with water during severe accident is being addressed.

In National Action Plan, were adjusted certain civil structures to improve their resistance to flooding of the technology due to heavy rains.

18.2 Incorporation of proven technologies

The principle of the use of proved technologies in the design and construction of a nuclear installation is established in the existing legislation. On the basis of these requirements, proved materials corresponding to the relevant regulations, technical standards or technical specifications were used for the design and manufacturing of reactor coolant system and its components including reactor pressure vessel; their sufficient capacity was supported by a theoretical calculation and experimental verification, and a reserve for degradation during operation was considered. The program and methods for the detection of the state of primary circuit were also defined.

In addition, legislation requires detailed review and, verification of the requirements for properties and validation of intended use for all processes and activities relevant to nuclear safety, in the framework of quality management and assurance system. The type, method and scope of review, verification and validation of the item, including the acceptance criteria, shall be defined for the process of the manufacturing of safety-relevant item before its use.

As for nuclear installation commissioning, the legislation requires to perform inactive testing, which includes a comprehensive functional verification of a nuclear installation and its revisions performed before the first loading of nuclear fuel into the reactor, active testing of a nuclear installation, which includes physical start-up 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.

Supervision of such activities is within the scope of competence of SÚJB, which is described in detail in Chapter 8.

18.3 Design for reliable, stable and manageable operation

Dukovany NPP

Over the years, the nuclear installation undertake a number of changes made to minimize the possibility of a human factor error and to improve the man-machine interface, especially in the control and limitation system with a view to ensuring reliable, stable and easy to control operation. The changes were implemented and are focused on both the main control rooms and the simplification of regular performance tests of individual installations. From the influence of human factor on reliability and safety of operation point of view, 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 renovated within the I&C system renovation project, provides fast and easy orientation of the main control room personnel during normal operation as well as during transients. The instruments ergonomic design was implemented as a result of the operator's demands. 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 analog 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 series of supporting computer programs facilitating the actual operation of installation, performing auxiliary calculations enabling to utilize the documentation in digitized form, etc.

Temelín NPP

The human factors engineering - ergonomics was already applied in the design of Temelín NPP man-machine interface. Application of the human factors engineering affects significantly the design from the perspective of the need for operation complexity of many integrated systems.

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. It 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 project 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 ČSN IEC 964 and ČSN IEC 965.13.2.

The issues of human factor including supervision of licensees in this field are addressed in Chapter 11.

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 release with the goal to prevent occurrence of accidents and to mitigate their radiation 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 analysis, 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 analyze 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 Initial authorization

The requirements for the commissioning of nuclear installations in the Czech Republic as well as for all stages of their operation are laid down so as to avoid an accident with radiological consequences and in the case of its occurrence, to mitigate the consequences of such accident, which is in compliance with 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 legislative 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:

- ***SÚJB Decree No. 144/1997 Coll.***, on physical protection of nuclear materials and nuclear installations and nuclear facilities and their classification, as amended by SÚJB Decree No. 500/2005 Coll.,
- ***SÚJB Decree No. 106/1998 Coll.***, on nuclear safety and radiation protection assurance during commissioning and operation of nuclear facilities,

- ***SÚJB Decree No. 307/2002 Coll.,*** on radiation protection, as amended by SÚJB Decree No. 499/2005 Coll., and SÚJB Decree No. 389/2012 Coll.,
- ***SÚJB Decree No. 318/2002 Coll.***, on details of emergency preparedness of nuclear facilities and workplaces with ionizing radiation sources and on requirements on the content of on-site emergency plan and emergency rule, as amended by SÚJB Decree No. 2/2004 Coll.,
- ***SÚJB Decree No. 185/2003 Coll.,*** on decommissioning of nuclear installations and workplaces of categories III and IV,
- ***SÚJB Decree No. 309/2005 Coll.,*** on assurance of technical safety of selected equipment,
- ***SÚJB Decree No. 132/2008 Coll.***, on Quality Assurance System in carrying out activities connected with utilization of nuclear energy and radiation protection and on Quality assurance of selected equipment in regard to their assignment to classes of nuclear safety.

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 and radiation protection. According to Section 13 of the Atomic Act approval of a quality assurance program for the practice being approved is a prerequisite for the issue of a licence for commissioning and operation of a nuclear installation.

Commissioning

An application for the issue of authorization for the individual stages of nuclear installation commissioning must be, in accordance with the Appendix C of the Atomic Act, accompanied with the following documentation:

a) For stages prior to loading nuclear fuel into a reactor:

- Time schedule for work in a given stage;
- Program for the stage in question;
- Evidence that installation and personnel are prepared for the stage in question;
- Evaluation of results of the preceding stage;
- Method by which physical protection will be provided.

b) For the first loading of nuclear fuel into a reactor:

I. Final Safety Report, which shall include:

- Description of changes of the original design assessed in the Preliminary Safety Report and evidence that there has been no decrease in the level of nuclear safety of the nuclear installation;
- Supplementary and more precise evidence of nuclear safety and radiation protection provisions;
- Limits and conditions for safe operation of the nuclear installation;
- Neutron-physics characteristics of the nuclear reactor;
- Method of radioactive waste management;
- Quality assessment of classified equipment.

II. Further documentation, which shall include:

- Evidence that all prior decisions and conditions of the SÚJB were fulfilled;
- Time schedule for nuclear fuel loading;
- Program for nuclear fuel loading;
- Evidence that installation and personnel are prepared for nuclear fuel loading;
- Evaluation of the results of previous stages;
- On-site emergency plan;
- Changes in the provision of physical protection;
- Program of in-service inspections;
- Proposed decommissioning method;
- Cost estimate for decommissioning.

c) For stages following the first nuclear fuel loading into the reactor:

- Time schedule for work in this stage;
- Program of this stage;
- Evidence that installation and personnel are prepared for the stage in question;
- Evaluation of results of the previous stage.

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 physical protection method, changes in physical protection assurance, proposed decommissioning method, on-site emergency plan, program of in-service inspections, as well as the Limits and Conditions for safe operation of a nuclear installation, are subject to a separate approval by the SÚJB.

Operation

Application for issuing the authorization for the nuclear installation operation must be, in accordance with Appendix D to the Atomic Act, accompanied with the following documentation:

- supplements to the Final Safety Analysis Report and further supplements to documentation required for the issue of a licence for the first nuclear fuel loading into the reactor, relating to changes carried out after the first nuclear fuel loading,
- evaluation of results of previous commissioning stages,
- evidence of implementation of previous decisions and conditions of the SÚJB,
- evidence that installation and personnel are prepared for operation,
- operation time schedule,
- up-dated limits and conditions for safe operation.

After 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.

Although the authorization for operation under the Act is not time-limited, the SÚJB issues during the operation, in accordance with the Section 9(1) e) of the Atomic Act, authorization for restarting a nuclear reactor to criticality after a nuclear fuel reload, based on review of the documentation submitted in accordance with Appendix E to the Atomic Act, i.e.:

- neutron-physics characteristics of the nuclear reactor,
- evidence that installation and personnel are prepared for restart of the nuclear reactor to criticality, including preliminary evaluation of in-service inspections,
- time schedule for subsequent operation.

19.2 Operational limits and conditions

Establishment of the Limits and Conditions for safe operation is required by the existing legislation – the Atomic Act and a set of its implementing decrees, 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 in 1982, following an initiative of the regulatory body. The concept was based on the US NRC reference guide 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 SÚJB Decree No. 106/1998 Coll., and includes the following data categories:

- Safety limits,
- Protection systems setting,
- Limiting condition for the operation (requirements for operation ability and acceptable values of parameters),
- Requirements for checks,
- Organizational measures,
- Reasons for the Limits and Conditions.

Limits and Conditions establishes the values of physical and technological parameters affecting directly 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 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 the 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 state, in which the respective requirements of the Limits and Conditions do not apply. The operator is obliged to inform the SÚJB on all deviations from the requirements of the Limits and Conditions, subsequently an analysis of the Limits and Conditions violation is performed and measures preventing repetition of such event are proposed.

Limits & Conditions for the Dukovany NPP

The first version of the Limits and Conditions for the Dukovany NPP units was elaborated in accordance with the US NRC reference guide. 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 taken into 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 emergency conditions (deterministic approach) and, when the limited technological system operation ability recovery time is fixed, they take the PSA results into account (probabilistic approach). The Limits and Conditions also reflect the calculation and experimental analyses and data, and are based on operational experience not only from the Dukovany NPP units with the VVER 440/213 reactors, but also from similar units in other countries (Slovakia, Hungary and Russian Federation).

Contents and internal segmentation of the Limits and Conditions are compliant with the requirements of the Atomic Act and SÚJB Decree No. 106/1998 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 in accordance with the NUREG 1431 document and their requirements are based on the prerequisites of safety analyses, documenting the plant safety at abnormal and emergency conditions. Contents and internal segmentation of Temelín NPP Limits and Conditions are compliant with the requirements of the Atomic Act and SÚJB Decree No. 106/1998 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) Substantiation 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 during 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 from the operational experience.

The revision of the whole document is executed periodically including justification of the Limits and Conditions.

19.3 Procedures for operation, maintenance, inspection and testing

Operation

Units of both power plants are operated in accordance with internal decrees and the Limits and Conditions for safe operation. These documents are continuously and systematically updated and upgraded. Compliance with the documents is continuously monitored through the implemented control system and addressed in the system for non-conformities, events and Near Miss.

The system catches all necessary and usable events. The plant personnel are familiar with the system and the system is used for the correction of discrepancies and defects. A great number of workers from all plant departments are involved in the process of identifying the causes of the problems and proposing effective corrective measures. The number of safety-relevant events is stable.

In Dukovany NPP as well as in Temelín NPP a system of WANO safety indicators evaluation is implemented, continuously providing information about the standards in the monitored areas in other NPPs in the world. Gathered information is used to recognize own level of Dukovany NPP and Temelín NPP in the individual indicators of the safety and operational status. The SÚJB uses the set of safety indicators to assess the nuclear safety level. The results of the safety indicators are shown in Annex 6.

Control documents defining the activities in the external and internal feedback process and the activities associated with the exchange of operational experience and technical information between the NPPs of ČEZ, a. s. and the operators of other nuclear power plants via the WANO network were prepared by the licensee.

Basic system standards establishing principles for safe and reliable operation control are the Operation Control and Procedures and the Production Equipment Operation and Monitoring.

The Operations Control Rules are formulated in accordance with the ČEZ, a. s. strategy so that their observance shall ensure safe, reliable and economic and environmentally friendly operation of the nuclear installation, in compliance with:

- conditions of the SÚJB authorization,
- provisions of the binding legal regulations of the Czech Republic (acts and their implementing decrees),
- operating procedures.

Operation of Dukovany NPP as well as of Temelín NPP is managed by the Operations Control Department. The division of responsibilities for the individual activities is defined in the corresponding quality assurance programs.

Special emphasis is put on preparedness and qualification of operating personnel, especially so-called “selected personnel”, i.e. personnel who have an immediate effect on nuclear safety (see Chapter 11). Also other operating personnel undergo selection, training and hands-on training for the relevant function.

Shift operation in Dukovany NPP as well as in Temelín NPP is ensured by six, or seven (for selected professions), equally competent shifts providing for the operation as well as for periodic training and proper rest of the personnel.

Within all unit modes both NPPs use the PSA risk monitor application for monitoring the unit operation risk. Data about unavailability of equipment is analysed for the reasons of tests, maintenance, and failures in all units. The analyses result in measures leading to the minimization of the operational risk.

When planning the equipment tests and maintenance, the outputs of the risk monitor are used to eliminate combinations of equipment unavailability, which are allowed by Limits and Conditions, but could increase the operational risk in the NPPs.

For more information about probabilistic safety assessment see Chapter 14.1.

Organization and activities during annual outages

The basic or key indicators of outage preparation and performance are:

1. nuclear safety,
2. radiation protection,
3. industrial safety,
4. scope of outage,
5. compliance with outage preparedness,
6. quality of human performance in outage.

The Outage Management Headquarters, made up of power plant managers and managers of main suppliers, is the top management body for outage at Dukovany NPP as well as Temelín NPP.

Preparation and progress of the outage in Dukovany NPP or Temelín NPP is controlled by a group of personnel nominated by the Coordination Department manager in the following composition (this can differ at each individual site as well as for specific outages):

- outage manager,
- primary circuit working group head,
- secondary circuit working group head,
- electro working group head,
- instrumentation and control working group head,
- head of the nuclear fuel working group.

An Outage Team may be also appointed by the Power Plant Manager for the preparation and course of the outage. The representatives of the main departments of the power plant and suppliers are appointed to the Outage Team. Shift maintenance dispatcher, who controls the work in accordance with the approved specification for afternoon and night shifts and for holidays, cooperates closely with this group of outage management. Each working group meets on a regular basis on working days for consultation meetings, where its members inform on the current state of the monitored activities, and where tasks directed to the fulfilment of the plan of works are assigned.

After the consultation meetings, consultation meeting of the outage control group is held, at which, additionally to the heads of the working groups, the reactor unit manager, shift maintenance dispatcher and the operation and nuclear safety representatives are present. During this meeting tasks for the next 24 (or for 72) hours are assigned. Orders for the shift personnel are also consulted here, which are concentrated into an official document, named Daily Operational Schedule, which is being issued daily.

Fulfilment of the assigned tasks is then checked and evaluated during the consultation meeting of the shift maintenance dispatcher in the presence of the outage manager, the heads of the working groups, coordination and representatives of the administration of property, which is held the following day at the beginning of the morning shift.

During the occurrence of non-standard states, which could jeopardize the scheduled progress of the outage, the outage manager calls together the Control Staff, which adopts, after having evaluated the event, measures for the correction of the state.

- Preparation of the outage begins at least six months prior to the scheduled date of its beginning, in accordance with the yearly outages scheduled. The yearly schedule is the further development of the five-year Power Plant Outage Plan and states also the presumed duration of the outage based on the standard whilst taking into account the needs for the implementation of the program of investments, reconstructions and modifications of power plant equipment: six months or according to the approved milestones prior to the outage, fulfilment check of the conclusions and measures from the preceding outage is performed and regular Coordination Consultation meetings are started.
- Two months prior to the outage the Coordination Department issues the schedule of the outage. The schedule includes decisive activities, which will be performed during the outage: The schedule includes maintenance including preventive maintenance; inspections and tests; important modifications of the equipment; order of the revisions of the individual electrical systems; availability of the safety systems and also includes logic links of the individual activities. The schedule includes also the sequence of important unit tests during the unit start-up. In the schedule its critical path is marked. From the perspective of the risk of reactor core damage, the outage schedule is assessed and optimized with the use of the probabilistic calculation (PSA).
- Two months prior to the outage, preparation of the work orders for scheduled outage activities is finished and work starts on grouping these orders into the securing ones and the safety related ones.
- One month prior the outage, a list of modifications and technical solutions, which will be carried out during the outage, is submitted to the SÚJB.
- One week prior to the outage at Dukovany NPP a document is issued (operative program), describing in detail activities, which will be carried out in the frame of the unit outage. The document includes also the time schedule. A similar document is elaborated also for activities during the unit start-up after the outage.
- One week prior to the outage of Temelín NPP, a meeting is held to confirm the correctness and feasibility of a detailed time schedule for unit outage.
- Approximately two days prior the reactor start-up an expert commission meets (Technical Committee) to judge, based on a report on the performed operational checks, whether the reactor and the pertinent equipment is ready for the restart.
- Subsequently an application for the authorization of the reactor restart is sent to the SÚJB.
- Within one month after putting the reactor into operation a report on the performed repairs on the classified equipment is submitted to the SÚJB.
- Within two months after the outage, a summary report on the outage including recommendations and measures for later outages is elaborated.

The outage structure is governed by the following philosophy:

- Safety is the first priority.
- One critical path is clearly defined.
- The outage takes into account the Shutdown PSA recommendations (probability of core damage frequency during outage and at low power levels).
- Systems and components with completed maintenance are tested in accordance with the approved procedure. These tests are performed by the Operations Control Department prior to placing them into normal operation.
- Progress of works being in the critical path and in its vicinity is monitored in detail.
- Information on the overall progress of the outage belongs to the information frame being daily submitted to the outage coordination group.

Maintenance

The mission of maintenance at the Dukovany NPP and the Temelín NPP is to ensure that the power plant is ready for safe, reliable and efficient energy and heat generation with the use of nuclear reactors and control all activities in the installation to ensure that the installations are:

- in accordance with the plant design,
- in compliance with the Czech legislation including harmonized EU legislation,
- in compliance with the recommendations of international organizations in nuclear industry,
- in compliance with the adopted technical standards and internal norms of the operator of nuclear installations.

The main objectives of maintenance also include the ensuring of required:

- nuclear, radiation and conventional safety,
- reliability of equipment, systems and nuclear generating units,
- compliance with the limits and conditions for safe operation, designed including their potential changes in accordance with the LTO conditions.

The main goal of maintenance is to ensure the required availability of the nuclear power plant technological equipment, timely removal of defects, their documenting and performance of monitoring.

Maintenance follows the Care of Assets Schedule, which is also part of the maintenance schedule. Initial sources of information for maintenance scheduling and performance are:

- Equipment manufacturers' recommendations and where appropriate, verified recommendations from qualified research and development organizations;
- In-service inspections program;
- Program of ageing monitoring of the main components;
- Results of the technical diagnostics of equipment;

- Preventive maintenance templates;
- Health Reports;
- Plant Life Management (PLIM) ;
- Ageing Management Programs (AMR);
- Information on the state of the equipment from maintenance interventions.

The Care of Assets Schedule is based on the applicable maintenance strategy, which is based on the preventive maintenance program. The Care of Assets Schedule reflects the scope, procurement and resources needed for the care of power plant assets.

The preventive maintenance program is compiled from the continuously re-evaluated preventive maintenance programs for particular equipment and process systems.

The maintenance carried out on power plant equipment is coordinated with the In-service Inspection Program and the In-service Test Program, conservatively reflects own experience, international good practices and new, proven scientific-technical knowledge, and has three forms:

- Periodic maintenance is based on the equipment manufacturers' recommendations.
- Maintenance depending on technical condition proposed and scheduled on the basis of the application of appropriate diagnostic methods in the detection of the technical condition of equipment and systems; prediction of the condition on the basis of the monitoring and evaluation of degradation processes; evaluation of the technical condition according to feedback information obtained from previous maintenance interventions on equipment. Maintenance depending on technical condition is linked to the investment program for the reconstructions and modifications of the equipment and systems of generating units, including LTO continuities and reflects both technical and technological progress, and potential moral obsolescence of equipment and the methods applied in equipment operation and maintenance.
- Corrective maintenance initiated by failures and identified non-conformities on equipment in operation, including settlement of temporary changes in technology.

The maintenance of nuclear power plants is contracted to qualified companies. For the purposes of setting out the scope of supply of maintenance work, the power plant is structured into seven logical units. Maintenance of a certain logical unit outsourced to the selected supplier on a long-term basis, which can use subcontractors under defined conditions and on the basis of certification according to ISO EN 9001.

Maintenance suppliers are evaluated, their activities are controlled, supervised and evaluated.

The Care of Assets Schedule (Maintenance Schedule) and the Outage Schedule are proposed with a five-year outlook. The implementation schedule is prepared on an annual basis, while the execution plans are prepared on a monthly or outage basis.

Inspections and tests

In addition to the introduced Inspection and Test Program (see Section 9.1.3), regular tests of the equipment are performed by the operating personnel of Dukovany NPP and Temelín NPP during the operation of units and during regular refuelling outages. Extent of the tests and their periodicity is given by the Limits and Conditions for safe operation and the Operating Procedures. Based on the requirements given by these documents annual time schedules of the tests are elaborated. For each test methods procedures are prepared, upon which the operating personnel act during the test. According to the test character, these tests are carried out either by qualified plant personnel or by qualified personnel of a supplier in cooperation with the corresponding experts from the plant. Each performed test is documented by a protocol or record.

Possibly identified deficiencies are eliminated, depending on their character and significance, in accordance with a system, described in the internal decrees of the plant. Those are formulated so that the requirements of the Limits and Conditions for safe operation and/or Operating Procedures are always fulfilled. Observance of the deadlines, actual performance and evaluation of the tests is controlled by independent control workers and by responsible managers.

Independent monitoring and evaluation of tests and inspections

Fulfilment and observance of requirements prescribed in the document Limits and Conditions are one of the highest priorities when assuring safe operation and is also the precondition for the fulfilment of safety analyses prerequisites. Limits and Conditions define the conditions for the operation of the unit, under which safety of the operation is proven. In the Temelín NPP systems are established for performance of checks in accordance with the Limits and Conditions, as well as for independent monitoring and evaluation of the correctness, effectiveness, and completeness of other documents and activities, susceptible to influence the fulfilment of the Limits and Conditions.

The requirement for performance of internal independent checks of the Limits and Conditions observance is included in the Limits and Conditions document. Execution of the inspections on the facility beyond the framework of the requirements for the inspections arising out of the Limits and Conditions is described in operating instructions; possibly it is executed based on the requirement and in compliance with quality assurance program according to prepared and approved operative program. These inspections are executed by the guarantor for individual systems and all responsible plant departments are familiarised with their results by the protocol.

19.4 Procedures for responding to operational occurrences and accidents

Procedures for activities carried out by the operating personnel and the unit main control room personnel are established in the Operating Procedures. All NPP operating documents underwent an extensive reworking during operation of both power plants. Operating Procedures are divided into two parts: Operating part - used by operators in the unit operation control. Descriptive part - contains, in addition to the detailed description of equipment, main operational states, design values and other necessary data, particularly used to explain the purpose, use and operation of equipment. They are formally prepared with the same philosophy for both NPPs. Databases of signals, protections and blocks, valves, drives, etc., were loaded in accordance with the documents revision. A new system of the databases provides for a better updating of the documents and is an important initial step for the preparation of the nuclear power plant´s extensive modernization.

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 in order 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 NPP, emergency operating procedures (AOPs, 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 procedures (AOP) are prepared for both NPPs. The AOPs are divided by equipment, the loss or failure of which causes failure state (Failures on the part of primary circuit, Failures on the part of 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 deals with the conditions during which the power level is not automatically reduced, but the solution of which can require, after a certain period of time, 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. Exception is the regulation P002a – Losses of I.O. and II.O. 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 executed modifications of Dukovany NPP and Temelín NPP.

The package of the EOP strategies includes a wide range of events within the emergency 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 emergency 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 operation of the units were involved in 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 emergency conditions is regularly trained at a full-scope 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 with 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 fault 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 in regard of severe accidents. In line with the good practice and international recommendations, the so-called SAMGs (Severe Accident Management Guidelines) 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 on the basis of 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 TH and minimization of radioactive releases to the environment. Activities according to the SAMG 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 SAMG. The SAMGs contain also 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 optimization 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 reactor is open, as well as guidelines for severe accidents, which would occur in 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 practised 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 SBO (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 ELAP (Extensive Lost of AC Power) and the so-called LUHS (Loss of Ultimate Heat Sink) including their combination. All the regulations are interlinked to the application of developed DAM (Diverse and Mobile) 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 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-scope simulator. Single procedures are also validates 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 emergency conditions is regularly trained at a full-scope 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 fourth level in accordance with the 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 organizational structure of the corporate section CI ČEZ, a. s., incorporates the following departments:

- NPP Engineering,
- Project Preparation and Implementation,
- Technical Support,
- Support and Planning,
- Design Authority.

The above departments execute and co-ordinate the activities of engineering and technical support, including the role of NPP Design Authority and NPP reliability and long-term operation management support. These central departments have a common competence for both Czech nuclear power plants. The responsibilities and rights of the CI section are clearly determined in control documents of ČEZ, a. s.

The key areas under the responsibility of the CI Section include particularly:

- design administration including the role of NPP “Design Authority”,
- equipment configuration change process management and execution.

The main tasks of the CI 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 equipments and specific equipments specially designed,
- Equipment classification process control,
- Preparation of long-term operation beyond the design lifetime (LTO),
- Ageing and life management as an integral part of 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., Production 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 departments of both NPPs, including Equipment Maintenance department as well as certain departments of the Safety and Asset Management sections, which are formally defined in ČEZ, a. s. control 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., EGP 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, close working relationship exists between the Design Administration and NPP Engineering departments.

Main tasks of the CI section in the field of **equipment configuration changes management** are as follows:

1. In the phase of pre-designing stage:

- Acceptance and assessment of requirements (Technical Initiations) of the equipment administration departments, operational departments and other departments of both NPPs for the equipment configuration changes,
- Analyses and preparation of 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 in regard 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.

2. 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 implementation of the equipment or system modifications, so that the equipment administration departments, or the operational departments are entrusted with the charge of modified and tested equipment including delivery of required documentation. The Engineering of NPP and Preparing and Realization of Projects cooperate even in evaluating 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 organization structure of 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 technical area, it closely co-operates with the NPP Engineering department.

19.6 Reporting of incidents significant to 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, in relation to 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 plants operational safety are established by the SÚJB Safety Guide JB-1.1 Chapter 4.2 “Principles of Communication between ČEZ, a. s. and SÚJB about events subject to legislative requirements”. The reporting procedures are described in the plant 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. SÚJB inspectors have on-line access to shift operational logbook. 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 SÚJB resident inspectors.

Statistics of events at nuclear installations in the reference year are presented in annual reports prepared by the SÚJB[18] (Annual Reports of the State Office for Nuclear Safety are issued only in Czech language). 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 14.3.

19.7 Operational experience feedback

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 in the course of its constructions and commissioning. At the same time also experience from international nuclear power plants, obtained from the IRS (Incident Reporting System) and WANO networks and from operators in Slovakia and experience from other site power plant in the Czech Republic and relevant non-nuclear industry, is used in the NPP. The whole process, which includes examination of the operational event and non-conformity causes, adoption of remedial measures and feedback of experience from these events and non-conformities, is ensured by specific departments in the relevant NPP and is described in relevant control documentation in individual NPPs.

The process covers methods for gathering information on operational events and non-conformities including Near Miss, their registration, investigation procedure, and analysis of their causes, 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 operational experience within the plant.

The events are evaluated according to the INES international scale for evaluation of event significance in the nuclear installations. A head of the Feedback section is responsible for the event-related investigation. This section coordinates the whole process of events investigation in the power plant, but also other further plant specialists from special departments 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 open communication setting and the admission of own mistakes is an acceptable impetus to improvement of the safety culture, whilst the priority is not to find the guilty parties, but to improve the condition ("blame-free atmosphere").

For regular evaluation of 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 control 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 annual report "Feedback from internal events".

All employees including suppliers are obliged to identify and record all events and non-conformities including Near Miss. Such records are classified by a multifunctional team into five categories, including designation of the department responsible for settlement.

Category 1 – events/non-conformities with a high uncertainty as to the correctness of settlement and a high risk of impacts severity and recurrence probability. A team-based root cause analysis with the subsequent efficiency evaluation of corrective measures is carried out for events/non-conformities. These events/non-conformities must be discussed by the Failure Commission of the

[18] http://www.sujb.cz/dokumenty-a-publikace/vyrocni-zpravy/vyrocni-zpravy-sujb/

relevant NPP and the causes together with the adopted corrective measures are regularly checked out by the SÚJB.

Category 2 – events/non-conformities with a high uncertainty as to the correctness of settlement and a medium risk of impacts severity and recurrence probability, or with a medium uncertainty as to the correctness of settlement and a high risk of impacts severity and recurrence probability. A root cause analysis with the group-based subsequent efficiency evaluation of corrective measures is carried out for events/non-conformities. These events/non-conformities must be discussed by the Failure Commission of the relevant NPP and the causes together with the adopted corrective measures are regularly checked out by the SÚJB.

Category 3 – events/non-conformities 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 (they are classified out of the INES scale). These events/non-conformities are investigated within the work order of the corresponding departments; these events are not discussed by the Failure Commission but the results of the investigation are communicated to the Commission; corrective measures are checked by the feedback of working group and checked and approved by the Failure Commission.

Category 4 – non-conformities including Near Miss with a 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 – proposal for changes in processes, activities, systems aimed at increasing their efficiency while maintaining the fulfilment of all requirements and expectations.

Recorded non-conformities 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 non-conformities, for which corrective measures are proposed and adopted, at its quarter meetings. In case of recurrence or on request of the management, system is set for the escalations of events/non-conformities to higher category.

The Events Investigation Commission (Failure Commission) is established as the advisory team of the executive director of NPP for identification of causes, corrective measures and conclusions for the events investigation in individual power plants, confirms at its regular meetings the completeness of the investigations of 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, after recommendation from the Failure Commission, transferred into the WANO network.

The most severe events at power plants of ČEZ, a. s. (nuclear, thermal and water power plants) are discussed at Failure Commission of Production Division and experience in these events is transmitted back to all power plants. This makes all important data and experience available to other NPP personnel to be used for the improvement of the plant operation reliability. The power plant personnel are informed on selected events both from internal and from external feedback.

All commissions are an element of the safety self-assessment of persons responsible for safety, and their activity and results are subject to independent supervision and evaluation by special departments that are not responsible for operating results.

In accordance with the law, the SÚJB supervises this process, and in some cases of important events, inspects the progress of examination and assessment of sufficiency of remedial measures taken in the course of 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 14.3.

External events

Both NPPs are actively involved in the system that enables sharing of event information (WER) within the framework of WANO - the international organization of nuclear power plant operators. This allows active and effective mutual cooperation with other NPP operators in operational experience exchange. Within the system of the use external experience, other sources are also used, e.g. IRS (IAEA), JRC Clearinghouse (European Commission). Analysis and utilization of operational experience and technical information from other operated nuclear power plants conduce to improvement of the NPP operation safety and reliability. When sharing own operational experience within the framework of WANO, ČEZ, a. s. NPPs conduce to 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 of the system 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),
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) reports and recommendations,
4. Direct information exchange between the operators (e.g. EDU - EBO, EMO, Paks),
5. Good practice, JIT information

Selected information from WANO, IAEA as well as INPO and OECD-NEA sources is included into agenda of the Safety Committees and Failure Commissions at both sites. All obtained information is archived in form of a database, and used by the technical department experts as technical support in solving problems.

19.8 Management of spent fuel and radioactive waste on the site

Basic objective

Radioactive waste and spent nuclear fuel management in the Czech Republic is regulated by the Atomic Act and SÚJB Decree No. 307/2002 Coll., on radiation protection. These legal documents define the rules and requirements for 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 transportation and storage. In the cask, spent fuel is stored in dry condition in the space filled with inert gas – He. Filled casks are deposited in spent fuel storage facilities at Dukovany NPP and Temelín NPP.

Radioactive wastes produced from normal operation of both nuclear power plants are continuously collected, sorted, processed and conditioned in the place of production and then stored within the Dukovany Radioactive Waste Storage Facility. With respect to ecological and economic conditions of the NPPs, radioactive waste storage in this storage facility represents an optimal option 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 storage facility is conditioned by processing the radioactive wastes into a form suitable for storage fulfilling the conditions for acceptability of the Radioactive Waste Storage Facility in Dukovany.

Waste waters 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 and the efficient elimination of historical waste stored at the NPP at the same time. Processed volumes of the concentrate are the minimum needed for the operation of the bituminisation lines at both NPPs. The film-type rotor evaporator is currently being adjusted at the Dukovany NPP in order to increase the operating reliability and efficiency of bituminisation process.

Solid Radioactive Waste is systematically sorted and its radioactivity is measured. On the basis of the measurements, a part of the waste with the content of radionuclides, which meets the criteria for the release of waste originated from controlled zones of both NPPs (release levels based on the EU, ICRP and IAEA documents) is discharged to the environment in a controlled manner in compliance with the legal regulations (SÚJB Decree No. 307/2002 Coll., on radiation protection, as amended by SÚJB Decree No. 499/2005 Coll., and SÚJB Decree No. 389/2012 Coll.). The remaining waste is characterized, processed, treated, and subsequently deposited to the Radioactive Waste Storage Facility. Fragmentation technologies are used for the processing of solid radioactive waste before conditioning. Decontamination, crushing, and low-pressure and high-pressure pressing and melting. Solid radioactive waste is treated with the use of technologies available in facilities of external suppliers 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 Storage Facility, are stored in NPP, with a view to depositing it in a deep geological repository.

Radioactive sediments and deteriorated sorbents are stored in the storage tanks and then fixed in geo-polymer matrices (SIAL and ALUSIL) characterized by their ability to bind high content of radioactive waste in the final product (> 20% of total solids). By the end of 2014, these technologies conditioned all deteriorated sorbents stored at the Dukovany NPP. 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 management of all kinds of radioactive waste produced in normal operation. The issues of potential radioactive waste from accidents are 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 optimization of processes during the waste treatment and processing. Minimization is understood as a complex process with direct impacts both in environmental and economic indicators of the NPP operator.

At NPP, the following measures are continuously implemented aimed at reducing the radioactive waste generation:

- development and implementation of decontamination technologies with a minimum waste production,

- separation of non-active sediments from the exchanger cleaning,
- separation, activity measurement and subsequent introduction of deteriorated sorbents and organic liquids into the environment,
- restriction of objects brought into the controlled area and unrelated to working activity,
- limiting entries of persons into the controlled area,
- optimization 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 SÚJB. All licensees for radioactive waste management are regularly controlled by 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 5.0, SÚJB, March 2014, [19][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.

[19] http://www.sujb.cz/fileadmin/sujb/docs/zpravy/narodni_zpravy/NZ_VP_RAO_5_0a.pdf

A N N E X E S

ANNEX 1 Description of the Dukovany and Temelín NPPs, and schedule of the performed safety improvements

Dukovany Nuclear Power Plant

Main components

1 Reactor

2 Main circulation pipelines

3 Main isolation valve

4 Main coolant pump

5 Steam generator

6 Pressurizer

7 Spent fuel pool

8 Refuelling cavity

9 Emergency core cooling system

10 Refuelling machine

11 Bubbler condenser

12 HVAC system

13 Ventilation stack

14 Reactor building crane

15 High pressure turbine

16 Low pressure turbine

17 Generator

18 Condenser

19 Separator-reheater

20 Regenerative heaters

21 Feedwater tank with feedwater deaerator

22 Steam piping into turbine

23 Cooling circulation circuit piping

24 Insulated cables for generator power outlet

25 High-voltage transformer of power output 400 kV

26 House consumption transformer 6 kV

27 Manipulation crane

Plant's technical parameters

Number of reactor units 4

Reactor type Pressurized water reactor VVER 440/213

Output parameters of one unit

Nominal thermal output	1444 MWt
Generator output	501 MWe
Net electrical output	470.5 MWe
Self-consumption	30.5 MWe

Reactor technical parameters

Reactor height	23.67 m
Pressure vessel inner diameter	3.542 m
Cylindrical part wall thickness	140 mm
Thickness of pressure vessel cladding	9 mm
Empty pressure vessel weight	215.15 t
Reactor weight	395 t

Reactor core

Number of fuel assemblies	312
Number of fuel rods per assembly	126
Number of control assemblies	37
Core height	2.5 m
Core diameter	2.88 m
Fuel enrichment	3,82*/4,25**/4,38**% U 235
Core loading (UO_2)	42 t
Fuel cycle	five years

* with profiled enrichment

** with profiled enrichment and burnable absorber

Reactor cooling system

Number of cooling loops	6
Inner diameter of main cooling piping	500 mm
Volume of coolant in primary circuit	209 m^3
Primary circuit working pressure	12.261 MPa
Inlet coolant temperature	approx. 267 °C
Outlet coolant temperature	approx. 297 °C
Reactor coolant flow	42 000 m^3 per hour

Steam generator (SG)

Number per unit	6
Steam production per SG	477 t.p.h.
Steam output pressure	4.751 MPa
Steam output temperature	260.7 °C
SG weight	approx. 165 t
SG body diameter	3.21 m
SG body length	11.80 m

Main coolant pump

Number per unit	6
Nominal power consumption	1.6 MW
Operational capacity	approx. 7000 m^3 per hour
Rotor speed	1460 r.p.m.
Pump weight	approx. 48 t

Turbine

Number of high pressure sections	1
Number of low pressure sections	2
Nominal rotor speed	3000 r. p.m.
Inlet steam temperature	254.9°C
Inlet steam pressure	4.318 MPa

Generator

Rated power	255 MW
Output voltage	15.75 kV
Nominal frequency	50 Hz
Cooling media	hydrogen - water

Condenser

Number per turbine	1
Number of pipes per condenser	31 716
Water flow	35 000 m^3 per hour
Pipe material	titanium

Cooling towers

Number per unit	2
Height	125 m
Diameter in top of the tower	59.49 m
Foot diameter	87.94 m
Wall thickness	0.6-0.15 m
Number of askew columns	104
Water flow (one tower)	approx. 10.55 m^3 per second
Volume of evaporated steam from one tower	max. 0.15 m^3 per second

Modernization changes already implemented in Dukovany NPP

A) Changes implemented within the "Back-fitting of Dukovany NPP"

1.	A7	Main coolant pump control algorithms modification
2.	A8	SG level measurement reliability improvement
3.	A12	Hydrogen recombination system within hermetic zone installation
4.	A21	High-pressure compressors replacement
5.	A23	Addition of redundant back-up to the category one power supplies No. 4
6.	A30	Teledosimetric system installation
7.	A32	Grab tank on Skryje stream installation
8.	B1	Cooling system installation for the machine halls roof steel structure
9.	B5	Stationary fire extinguishing equipment installation for central oil system
10.	B7	Unit electrical fire detection system upgrade
11.	B10	Stationary halon fire extinguishing system installation for unit electrical equipment

B) Changes implemented within the "Modernization of Dukovany NPP"

1.	ZL 1702	Installation of electrical fire detection system at water pump station "Jihlava"
2.	ZL 2180	Modernization of system for public warning during accidents
3.	ZL 2374	Construction of interim spent fuel storage facility
4.	ZL 3103	0.4 kV switchgears upgrade
5.	ZL 3582	Hydroaccumulators isolation valves control
6.	ZL 3664	32/16/16 MVA back-up unit auxiliary transformer installation
7.	ZL 3701	Pressure measurement in the SG box
8.	ZL 3704	Reconstruction of the protection actuated by "MSH break" signal
9.	ZL 3818	EDU surroundings teledosimetric system - radiation control data transfer
10.	ZL 3863	Fire-proof spraying of critical and important cable rooms
11.	ZL 4290	Pressurizer safety valve's keys modification
12.	P588	Innovation of boronmeters
13.	P590	AKOBOJE (nuclear power plant automatic security guard complex) optimization
14.	P591	Replacement of Freon in cold supply system
15.	P598	Chemical water treatment station modernization
16.	P601	Conversion of documentation to the digital form
17.	P602	Main control room full scope simulator

18.	P606	Flats construction for the EDU employees
19.	S150	Condenser reconstruction
20.	S357	Post-emergency hydrogen recombination
21.	S439	Replacement feeding water line for the I&C sensors flushing system
22.	S568	Spray system's sumps protection
23.	S675	Replacement of water and oil coolers in the diesel generator I station
24.	S765	Condensate treatment system modernization
25.	S776	Diesel generators electrical system reconstruction
26.	S907	Extension of stable sprinkling device functions
27.	S952	Construction of intermediate floor in the panel intermediated relay's rooms and common control rooms
28.	T130	Construction of new telephone switchboard
29.	T215	The Jihlava Pumping Station I&C reconstruction
30.	T248	Pressurizer safety valve (relief valve) node reconstruction
31.	T263	Auxiliary feedwater pump replacement
32.	T317	Replacement of water and oil coolers for diesel generator II station
33.	T370	Replacement of storage pool pumps by a sealess type
34.	T516	Fitting of diodes in I&C switchboards
35.	T547	Batteries replacement in First category power supplies system No. 4
36.	T556	Control room diesel generator annunciation upgrade
37.	T703	Ultimate emergency feedwater pump to SG section collector displacement
38.	T764	Secondary circuit continuous measurement system installation
39.	T785	Intermediate building +14,7 pipeline whip restraints
40.	T802	Section switchboards service inlets of selected consumers reconstruction
41.	T982	Fire protection barriers
42.	T983	Fire protection barriers
43.	T984	Fire protection barriers
44.	T996	Access path to cooling towers
45.	U064	Coating of the main production unit II, primary part of 3rd and 4th reactor unit
46.	U097	Chemical water treatment continuous measurement
47.	U116	Bringing out of „Danger of SG overpressurising“ signal
48.	U247	Coating of cable rooms in transversal and intermediate building and turbine hall – reactor unit No.1
49.	U444	Outside transformer basements
50.	U496	Exhausting of storage pool
51.	U560	Reconstruction of drinking and fire water in Dukovany NPP, stage II

52.	U584	Emergency lightning of chemical neutralization building
53.	U685	Revitalization of AKOBOJE (nuclear power plant automatic security guard complex) and arrangement of Back-up control centre
54.	U697	Emergency venting of primary circuit
55.	U725	Covering of rail access corridor of main production units I, II
56.	U726	Replacement of pressure measurement recording devices
57.	U754	Protection of DIAMO K input signals
58.	U775	Elimination of the scram protection signal – the pressure in the main steam collector
59.	U777	Assuring of the NPP Dukovany tertiary regulation
60.	U780	Assuring of the NPP Dukovany secondary regulation - main production units I and II
61.	U876	Upgrade of the SCORPIO-VVER system
62.	U917	Modification of the DukNet computer network
63.	U919	Modification of the turbogenerator drip tank
64.	U950	Modification of internal connecting pipelines of auxiliary service buildings for primary systems
65.	U969	Checking of bitumenation in the low-level waste treatment
66.	V015	Reconstruction of the air conditioning P – 460, 461, P – 470 in the operational building II
67.	V059	Reconstruction of de-mineralized water pipelines including fittings
68.	V061	Modification of SW extractor data from central information system of radiation control for emergency coordination centre of Regulatory body
69.	V062	Modernization of Monitoring system electric – binary part
70.	V063	Modernization of Monitoring system electric – analog part
71.	V064	Modernization of Monitoring system electric – central unit
72.	V066	Superstructure of diagnostic systems for free parts monitoring
73.	V077	Modification of information system LOIS
74.	V078	Upgrade of the Genie Inspector software
75.	V082	Modification of the DARS system
76.	V103	Separation of turbine-generator intermediate circuits
77.	ST152343	Heating steam inlet regulation for condenser-deaerator
78.	ST153272	Elimination of electronic fire alarms false signals
79.	ST153589	Feeding water and steam balance disturbance signaling
80.	ST153919	Construction of the waste management center near by the auxiliary boiler plant
81.	ST154113	Auxiliary power supply for the 9CN201 switchboard
82.	ST154119	Effluent measurement in the VK1 ventilation stack

83. ST154173 Signaling of flooding of underground areas in turbine hall

84. ST154782 Completion of eyes' rinsing devices in auxiliary service buildings for primary systems

85. ST154897 Installation nets for windows in the turbine hall

86. ST155021 Cooling of panel intermediated relay-2 and panel intermediated relay-3 in 3rd reactor unit

87. ST155038 Assuring of the internal contamination measurement during loss of DukNet-Genie2000

88. ST155039 Exchange of comparative protection of the V483-6 line

89. ST155042 Virtual power plant

90. ST155054 Enlargement of the alpha server 3 RAM and HDD capacity

91. ST155055 Assuring of substitutional effluent measurement in Laboratory of radiation control of environment

92. ST155070 Modification of the ARS software (physical protection system)

93. ST155075 Upgrade of SCORPIO – VVER II

94. ST155099 Air elimination from the cold supply plant condenser

95. ST155100 Separation of turbine-generator intermediate circuits

96. ST155102 Information system security increasing in NPP Dukovany

97. ST155124 Replacement of the I&C equipment in the intermediate building +14.7 m - reactor unit 2

98. ST155189 Exchange of PC/reactor operator, PC/turbine operator, PC/SERVIS BLAN

99. ST155197 Installation and operation of "Photovoltaic power station" in NPP Dukovany

100. ST155198 Modification of Data terminal equipment and Secondary regulation promoter NPP Dukovany for tertiary regulation in remote control

101. ST155379 Application of DART in NPP Dukovany

102. ST15U875 Turbine hall equipment - pH increasing

103. ST155567 Installation of tilted rail

104. ST154561 Strengthening of high energy pipelines

105. ST153786 Motors drives of valves on +14,7 m level of intermediate building

106. ST155213 Upgrade of N16 measurement

107. ST155108 Contamination measurement of persons on Dukovany NPP area borders

108. ST155184 Seismic strengthening of TS10,50W01,02

109. ST155300 Seismic strengthening of dieselgenerator station (DGS) 2 (units 3,4)

110. ST154482 Dieselgenerator (7-12) reconstruction

111. ST154440 Measurement of H_2 concentration in systems TS10, TS50

112. ST154635 Rupture protection of HNK (main feedwater header) and HVK (main discharge header) - mechanical part

113. ST155158 Seismic strengthening of DGS

114. ST155171 Installation of identification card scanner in the entry to shelters

115. ST154481 Dieselgenerator (1-6) reconstruction

116. ST155367 Equipment qualification - seismic analyses, type tests

117. ST155444 DG overspeed protection algorithm modification

118. ST155036 Installation of internal emergency siren at education and training centre

119. ST154226 Replacement of fire-protection doors

120. ST154685 Revitalization of AKOBOJE (nuclear power plant automatic security guard complex) and arrangement of Back-up control centre – creation of dislocation conditions

121. ST154554 Detection system of leakage amount from primary circuit

122. ST153102 Reconstruction of secondary distributors

123. ST154587 Completing of primary pipe whip restraints

124. ST155012 Change of automatics on arm. TQ22,42,62S02 opening

125. ST155173 Relieving the shortage of HV electric equipment qualification

126. ST155185 Seismic resilience and adaptation of min. ultimate emergency feedwater pump to SG control

127. ST155202 TC10,50S01 power supply from class I power supply

128. ST155215 Change of ESW pipeline dimension for TL10 coolers

129. ST155308 Exchange of DME series sensors (measuring of Level, Temperature and Pressure) in RA, TH, TJ, TQ, XL, YA, YC, YP systems

130. ST155481 Exchanging of pipeline of ESW for cooldown condenser

131. ST155483 Flanged connection to SG blowdown line.

132. ST155504 Replacement of electro-driven valve Klimact for hand valves

133. ST155512 Change of opening automatics on TQ22, 42, 62S02 valves.

134. 5314 Seismic hardening of the I&C equipment

135. 5235 Ensuring of qualification requirements for the cable trays on Unit 3

136. 5748 Hot water heating of gas tank detention of restraint systems

137. 5756 Replacing the electric drives 7.229.1-3 for seismically resistant

138. 5177 Removal of seismic lacks from EQ at electronic devices

139. 5844 Replacing of the CYAY and CYKY type safety cables (including LTOKA26), safety issue category III

140. 5234 Hardening (seismic) of the buildings 1A, 2A, 3A, 4A 2.3

141. 5322 Provision of seismically resistant spread area of ESW in the cooling tower

142. 5535 Prevention of complete loss of coolant during LOCA

143. 5728 Implementation of a new alarm system from the mean level in the pressurizer at the main control room

144. 5797 Reconnecting of DC oil pumps of TG (run-down oil pump - DC and emergency shaft seal pump - DC) from UPS 1 and 2 to UPS 4

145.	4026	Replacement of electronic fire alarms Tesla and sensors in pipe and cable ducts
146.	6690	Using of innovative modules of Scorpio
147.	6511	Reconstruction of high-volume sampling of aerosols in the ventilation stack 2
148.	6540	Changing of settings of RLS
149.	6286	Increasing of the number of impellers of pumps 4TK20,60D02
150.	5612	Ionization chambers - neutron noise measurement
151.	5666	Reconstruction of continuous analyzers of primary circuit
152.	5711	Integration of HW and SW failure of the control signals of DG to remote signalling
153.	5762	Modification of cooling junction of sealing oil of generators
154.	5766	Adaptation of roof trusses of turbine building of main production units I,II
155.	5817	Adaptation of circuit of monitoring of the control voltage of Automatic Reserve Substitution
156.	5876	Upgrade of RTARC program at the Dukovany NPP
157.	6535	Replacing of safety cables in HELB conditions
158.	6554	Replacing of safety cables in LOCA conditions at the unit 2
159.	6604	Replacing of safety cables in LOCA conditions at the unit 1
160.	6605	Replacing of safety cables in LOCA conditions at the unit 4
161.	6633	Cable structure at the longitudinal building +14.7 meters and replacement of cables in the primary circuit – unit 4
162.	6672	Replacing of unqualified cables during refuelling outage of unit 3 in 2011
163.	6675	Replacing of unqualified cables during refuelling outage of unit 2 in 2011

Temelín NPP

Main components

1. Reactor
2. Main circulation pipelines
3. Main coolant pump
4. Pressurizer
5. Steam generator
6. Polar crane
7. Spent fuel pool
8. Refuelling machine
9. Hydroaccumulators
10. Containment
11. Ventilation stack
12. Emergency core cooling system
13. Diesel generator station
14. Turbine hall
15. Feedwater tank
16. Main steam piping
17. High pressure turbine
18. Low pressure turbine
19. Generator
20. Exciter
21. Separator
22. Condenser
23. Heat exchanger
24. Coolant inlet and outlet
25. Pumping station
26. Cooling water pump
27. Cooling tower
28. Generator power outlet
29. Transformer
30. Power output
31. Distillate reservoirs

NPP technical parameters

Number of units	2
Reactor type	PWR VVER 1000

Unit parameters

Nominal thermal output	3120 MWt
Generator output	1080,25 MWe
Net electrical output	1125 MWe
Self-consumption	50 MWe

Reactor technical parameters

Reactor height	10.9 m
Pressure vessel inner diameter	4.5 m
Cylindrical part wall thickness	193 mm
Thickness of pressure vessel cladding	7 – 18 mm
Reactor weight without coolant	approx. 800 t
Pressure vessel weight	322 t

Reactor core

Number of fuel assemblies	163
Number of fuel rods per assembly	312
Number of rod cluster control assemblies	61
Height of active core	3.6 m
Core height	3.1 m
Fuel enrichment	max. 5 % U 235
Core loading (UO_2)	92 t
Fuel cycle	four years

Reactor cooling system

Number of cooling loops	4
Inner diameter of main cooling piping	850 mm
Volume of coolant in primary circuit	337 m^3
Primary circuit working pressure	15.7 MPa
Inlet coolant temperature	approx. 290 °C
Outlet coolant temperature	approx. 320 °C
Coolant flow	84 800 m^3 per hour

Steam generator (SG)

Number per unit	4
Steam quantity produced in 1 SG	1470 t/h
Outlet steam pressure	6.3 MPa
Outlet steam temperature	278.5 °C
SG weight	approx. 416 t
SG body diameter	4.2 m
SG body length	14.5 m

Main coolant pump

Number per unit	4
Nominal power consumption	5.1 – 6.8 MW
Operational capacity	approx. 21 200 m^3 p. hour
Rotor speed	1000 r.p.m.
Pump weight	approx. 156 t

Containment system

Height of cylindrical part	38 m
Inner diameter of cylindrical part	45 m
Wall thickness	1.2 m
Thickness of stainless steel liner	8 mm

Turbine

Number of high pressure stage	1
Number of low pressure stage	3
Rotor speed	3000 r.p.m.
High pressure stage weight	205 t
Low pressure stage weight	480 t

Generator

Rated apparent power	1250 MVA
Power factor	0.9 IND
Output voltage	24 kV
Nominal frequency	50 Hz
Cooling media	hydrogen – water
Weight	564 t

Condenser

Number per turbine	3
Number of pipes per condenser	approx. 32 000
Pipe length	12 m
Pipe material	titanium

Cooling tower

Number per unit	2
Height	154.8 m
Diameter in top of the tower	82.6 m
Foot diameter	130.7 m
Wall thickness	0.9 – 0.18 m
Number of askew columns	112
Water flow (one tower)	approx. 17.2 m^3/s
Volume of evaporated steam from one tower	max. 0.4 m^3/s

Modernization changes already implemented in Temelín NPP

1. I&C Systems replacement
2. Nuclear fuel, control clusters (lifetime)
3. Radiation monitoring system (RMS)
4. Primary circuit diagnostic system (TMDS)
5. Sipping - identification and quantification of the fuel assembly damage
6. Bitumination system
7. Refuelling machine I&C system replacement
8. Installation of compact grid in the spent fuel pool
9. Full scope simulator
10. Technical support center
11. Inverters, rectifiers (AEG)
12. Penetrations (Škoda + ISTC Company)
13. Replacement of J2UX circuit breakers
14. Unit transformer penetration (Passoni Villa bushings)
15. Addition of back-up power supply for main production unit No. 2
16. Addition of a common back-up diesel generator station (DGS)
17. Increase of accumulator batteries capacity
18. Implementation of "reserve electrical protections" and provision for full selectivity in 6 kV radial electrical networks
19. Pressurizer electrical heaters continuous control
20. Installation of hydrogen recombination system
21. Post-accident hydrogen monitoring system
22. Replacement of selected valves
23. Reconstruction of stabile fire extinguishing system for outdoor power transformers
24. Introduction of secondary load follow regulation
25. Construction of plant terminal (TELETE)
26. Modification of the ESW and non-ESW systems
27. Replacement of pumps
28. Modification of containment sump system
29. Containment venting (single failure)
30. Titanium condenser pipes installation
31. RCCA drives replacement
32. Introduction of new chemistry control
33. New safety analysis

34. ATWS analysis
35. PSA level 1 and 2 development project
36. Severe accidents analysis
37. SW independent verification & validation project (IV&V)
38. Leak Before Break project
39. EOPs development project
40. SAMG development project
41. Fire safety, cables, electronic fire detection system
42. Seismic analysis
43. Completion documentation of Selected Equipment
44. ISE project (information systems of NPP)
45. Modification of SG inner parts
46. Addition of new SG water level measurement
47. I&C system for polar crane
48. Filtration system for emergency control room
49. Modification of main control room venting system
50. Installation of GERB absorbers
51. Addition of drench fire extinguishing system for main coolant pumps
52. Addition of radioactive waste treatment system for liquid wastes liquidation after accidents
53. Addition of system for collection of boric water and system for separation
54. Replacement of asbestos sealing
55. Installation of new heat-exchangers of active safety systems
56. Addition of relief valve in pressurizer system
57. Replacement of SG steam pipes quick-acting valves
58. Modernization of main coolant pumps
59. Organized depository of high activity wastes
60. Replacement of Freon in cooling systems
61. Nuclear safety improvement (high energy piping separation)
62. Unit fire safety improvement
63. Nuclear safety improvement - improvement of SG safety relief valves functionality
64. Nuclear safety improvement - improvement of steam drain to atmosphere functionality
65. Essential and non-essential cooling water lines redesign
66. SG steam flow measurement method improvement
67. 1000 MW turbine high pressure control valves redesign
68. Condensate pumps improvement
69. Diesel generator electrical protection system modernization

70.		Main divisional category II 6 kV switchboard (and selected non-unit 6 kV switchboard) emergency arc protection replacement
71.		Electrical inverter replacement (UPS for all the safety system motory loads)
72.		Radiation safety information system
73.		Turbine trip logic algorithm improvement
74.	10220	Modernization of NPP Temelín seismic network including supplement of seismic station
75.	10242	Algorithm for overwriting fixed pressure value in main steam header if Reactor scram or Limitation System take effect and SG level is below 185 cm
76.	10809	Function "Subcooling & Fixed High Thot" – elimination of inconsistency between RCLS and PRPS
77.	10846	Reconstruction of facility for liquidation of neutron flux detectors and thermocouples
78.	10131	Exchange of valve 1(2)TX41-44S01,02 motors
79.	10299	Design and documentation for exchange of existing nickel sealing of filter covers 1 (2) TC 10, 20, 30, 40 NO 1 by ridge-shape sealing
80.	10072	Replacement of existing Russian electromotor 4A315S6A5U3 cooled by water by motor with air cooling
81.	10776	Spent fuel pool Cooling in nominal operation after Fast acting valves on TG lines lockup.
82.	10798	Modification of inlet of impulse lines of pipelines, venting, and drainage lines from main technological line systems 1(2) TQ, 1(2) TC, 1(2) TK, 1 TG, 2 YD
83.	10832	Exchange of pressuriser electroheaters sealings
84.	6739	Exchange of flash protection
85.	6784	DGS protection modification
86.	7118	Exchange nickel and asbestos-graphitic sealing of manhole pressurizer for ridge-shape sealing.
87.	7119	Exchange of existing nickel sealing of primary collectors, secondary lids and side opening
88.	10193	Supplement of nitrogen to thermosifons of Sulzer SO 800/04 pumps
89.	7064	Noise reduction in room No AE 340/3
90.	A025	Replacing of manual valves of UE system with motor operated remote control valves for hydrogen refilling.
91.	A070	LS signal "Shutoff the steam supply on bypass valve to condenser"
92.	A130	Adding of control valves on the outlet of pumps 1(2)TQ12(22,32)D01
93.	A234	Modifications on ESW
94.	A276	Replacement of sampling device for steam flow measuring from SG.
95.	A385	Modification of input HW for temperature measuring of primary circuit loops
96.	A427	Modification of tanks 1(2)TQ14(24,34)B01 mixing
97.	A545	Modification of emergency power supply in building No. 800 - replacement of sensors in GA407/1,2
98.	A556	Ridge-shape sealing of reactor main coolant pumps auxiliary flanges

99.	A573	Changing of the selection of electric heater system TS20 1(2)TS31(32,33)W02(W03)
100.	A643	Penalization from AFD in PRPS
101.	A685	Control system for testing of the pressurizer safety valves
102.	A764	MCP shell closing with pressure blanking
103.	A789	Replacement of the TSFO (physical protection technical system) control system and its optimisation
104.	A799	Installation of LKP-M/3 into trial operation
105.	A902	Reduce of discrepancy probability in the control rod system - unit 1
106.	A923	Reduce of discrepancy probability in the control rod system – unit 2
107.	A954	Modification of RCS sampling system and post-accident sampling system (PASS a PAGSS)
108.	A960	Elimination of steam line 2Tx80 vibrations in A820
109.	A969	Replacement of oil breakers in substation 6 kV at main production building No. 1
110.	A987	EPS - Replacement of superstructure system DMS 7000 and group MS9
111.	A994	Back-up entrance
112.	B106	Modification of pressurizer safety valve supply line and flange sealing method
113.	B133	Completion of radiation monitoring measuring instrument for containment exit
114.	B224	Replacement of blowers 1(2)TS11,12,13D01
115.	B260	Facility for disposal of neutron measurements detector and boron regulation system
116.	B263	Reduction vibrations of inlet steam pipeline toward the steam bypass station to atmosphere 1(2)TX60S05 at a low power operatin
117.	B270	Modification of the relief pipeline on the ESW pumps
118.	B305	Replacement of the linear step drive
119.	B340	Modernization of DHG (Data Highway Gateway) for PRPS
120.	B363	Modification of emergency protection function from the high temperature in the hot leg
121.	B053	Implementation of new signals FAS (according to corrective measures 17/203/04, 18/187/05, and other initiatives)
122.	B116	The replenishment of controlled entries to the containment and surrounds of main production unit I and II
123.	B124	Modification of technological venting of SG primary collector
124.	B420	Reconstruction of wiring of heaters 1,2TS14,15W01,02,03
125.	B362	Modification of the function generator of requested pressure in the primary circuit
126.	B380	Emergency power supply of ZIRU at the emergency control room of main production unit 1 and 2
127.	B391	Modification of damping plate - tightness when filling / drainage of spent fuel pool
128.	B401	Connection of lines 1(2)YR60Z01.1 and 1(2)YP24Z01 directly into the bubbler tank
129.	B427	Blocking of action of limiting system (A) during shutdown of running TG
130.	B430	Replacement of ionization chambers of physical start-up desk

131.	B459	Replacement of mechanical seal of pumps 2TQ12(22;32)D01
132.	B460	1(2)VF-Adding of closing valves into ESW pipeline prior to enter into the suction sumps at pump stations of ESW
133.	B462	Hardening of the containment - the elimination of accidental hydrogen
134.	B464	Spent Fuel Storage Facility building in Temelin site
135.	B541	The replenishment of bypass of check flap valves at the outlet of ESW at pumping station of ESW
136.	B553	Replacement of return valve 1(2)VF10(20;30)S16;S17
137.	B624	Change of position of valves 1,2TK40(50)S01,02 a 1TK80S01,02,03
138.	B718	Increasing of the thermal powet of the reactor VVER-1000 V320 ETE 1, 2 using design reserves
139.	B719	Replacement of dampers GERB at the SG´s, main circulating pumps shells and steam lines inside the containment
140.	B730	Modernization of the flow part of the turbine’s low pressure parts
141.	B732	Increased of measurements of noble gases reliability in ventilation stack
142.	B738	Modification of PAMS in the status tree CSF "Containment"
143.	B757	Replacement of toroidal compensator of reactor shaft
144.	B769	Replenishment of closing valves DN 600 into line 1VF40(50,60)Z01
145.	B864	Repair of pressure mesurement 2YA20P14B at main circulation pipeline 2YA22Z01 using a manipulator MONT-10
146.	C078	Replacing of engine of auxiliary feedwater pumps
147.	C119	Implementation of activities of UIS integration and modifications of displays for outages of unit 1and unit 2 in 2010
148.	C158	Modification of the pump discharge line 1TQ33D01 to reduce vibration
149.	C210	Removal of vibration of pump discharge line 2TQ32D01
150.	C225	1TZ40S03, S06 - insufficient space above the valve for removing of air receiver and the whole valve
151.	C262	The replenishment of bypass of ESW for TG exchanger
152.	C294	1(2)VF40(50,60)F001- change of disposition of sampling point (corrective measure 02/99/09)
153.	C301	Change the setting of emergency protection of safety systems in connection with the new fuel TVEL
154.	C302	VF - change of the type of valves for cooling basins with a sprinkler system
155.	C305	Prevention of uncontrolled lapse of cluster at AC supply of cabinets Panels of power control of clusters outside the tolerance band
156.	C316	1(2)VF- replacement of diameter and material for impulse pipeline measurement of ESW system
157.	C349	Service power supply of the Radiation Monitoring Network - signalling of outlets power supply

158.	C380	Reassessment of the requirement for operability of TQ40S05
159.	C445	Handling hole for the operation documentation
160.	C593	Changing of the alarm values of vacuum in the containment (TQ10,20,30P016 and TQ10P916)
161.	C615	Implementation of activities of UIS integration and modifications of displays for outages of unit 1and unit 2 in 2011
162.	C707	Design and supply of a new membrane of bubbler tank
163.	C745	Changing the position of block of protection tubes required for the implementation of the new fuel TVSA-T
164.	C797	Device for limit samples purchasing from tanks 1(2)TQ14(24,34)B01
165.	C867	Implementation of activities of UIS integration and modifications of displays for outages of unit 1 and unit 2 in 2012
166.	C884	Supplement of electric fire alarms in some fire sections in building 800 and SO 801/3
167.	C907	Improving of the staff working environment in the building 444/02 (common reserve diesel-generator station 01)
168.	D052	Modifying of check valves DN 300 on low pressure TQ and YT systems
169.	D157	Bridge of transport part of reactor building – solution of excessive deformation
170.	D337	Diverse system for heat removal from the core through the secondary circuit
171.	D338	Diverse system for feeding of depressurised primary circuit, spent fuel storage pool and GA201
172.	D340	The change of the category of emergency power supply for two valves TL22/42
173.	D428	Modification of sealing joints of flanges of selected valves of systems TC,TK,TQ,TX,YP a YT
174.	D467	Replacing of SG's pilot operated safety valve due to damage of the valve seat in the transition between the weld material and the base material
175.	D661	Replacing the dampers GERB on the PZR safety valve exhaust line
176.	D860	Alternate filling of spent fuel pool, primary circuit, containment (flexible connections)
177.	D976	Emergency electronic personal dosimetry system
178.	E368	Modification of mounting no. 15 (16, 24) on the pipeline routes 1(2)TQ50Z51(Z52,Z53) near penetrations into the GA201

ANNEX 2 IAEA safety recommendations fulfilment status

Safety issues solution status for the NPPs with VVER-440/213 at the Dukovany NPP

Ident.	Name of the safety findings	Cat.	State
G	**GENERAL**		
G01	Classification of components	II	4
G02	Qualification of equipment	III	3
G03	Reliability analysis of safety class 1 and 2 systems	II	4
RC	**CORE**		
RC01	Prevention of uncontrolled boron dilution	II	4
CI	**COMPONENT INTEGRITY**		
CI01	RPV (reactor pressure vessel) integrity	II	4
CI02	Non-destructive testing	III	4
CI03	Primary pipe whip restraints	II	4
CI04	SG collector integrity	II	4
CI05	SG tubes integrity	II	4
CI06	SG feedwater distribution pipe	I	4
S	**SYSTEMS**		
S01	Primary circuit cold overpressure protection	II	4
S02	Mitigation of a SG primary collector break	II	4
S03	Reactor coolant pump seal cooling system	II	4
S04	Pressurizer safety and relief valves qualification for water flow	II	4
S05	ECCS sump screen blocking	III	4
S06	ECCS suction line integrity	II	4
S07	ECCS heat exchanger integrity	II	4
S08	Power operated valves on the ECCS injection lines	I	4
S09	SG safety and relief valves qualification for water flow	II	4
S10	SG safety and relief valves performance at low pressure	II	3
S11	SG level control valves	I	4
S12	Emergency feedwater make-up procedures	I	4
S13	Feedwater supply vulnerability	III	4
S14	Main control room ventilation system	II	4
S15	Hydrogen removal system	II	4

Ident.	Name of the safety findings	Cat.	State
S16	Primary circuit venting under accident conditions	II	4
S17	Essential service water system (ESW)	II	4
I&C	**I&C**		
I&C01	I&C reliability	II	4
I&C02	Safety system actuation design	I	4
I&C03	Review of reactor scram initiating signals	II	4
I&C04	Human engineering of control rooms	II	4
I&C05	Physical and functional separation between the main and emergency control rooms	II	4
I&C06	Condition monitoring for the mechanical equipment	I	4
I&C07	Primary circuit diagnostic systems	II	4
I&C08	Reactor vessel head leak monitoring system	II	4
I&C09	Accident monitoring instrumentation	II	4
I&C10	Technical support center	II	4
I&C11	Water chemistry control and monitoring equipment (primary and secondary)	I	4
EL	**ELECTRIC POWER SUPPLY**		
EL01	Start-up logic for the emergency diesels	I	4
EL02	Diesel generators reliability	I	4
EL03	Protection signals for emergency diesel generators	I	4
EL04	On-site power supply for incident and accident management	II	4
EL05	Emergency battery discharge time	II	4
C	**CONTAINMENT**		
C01	Bubbler condenser strength behaviour at max. pressure difference possible under LOCA	III	4
C02	Bubbler condenser thermodynamic behaviour	II	4
C03	Containment leak rates	II	4
C04	Maximum pressure differences on walls between compartments of hermetic boxes	II	4
C05	Peak pressure in containment and activation of sub-atmospheric pressure after blowdown	I	4
IH	**INTERNAL HAZARDS**		
IH01	Systematic fire hazards analysis	II	4
IH02	Fire prevention	III	4
IH03	Fire detection and extinguishing	II	4

Ident.	Name of the safety findings	Cat.	State
IH04	Mitigation of fire effects	II	3
IH05	Systematic flooding analysis	I	4
IH06	Turbine missiles	I	4
IH07	Internal hazards due to high energy pipe breaks	III	4
IH08	Heavy load drop	I	4
EH	**EXTERNAL HAZARDS**		
EH01	Seismic design	III	3
EH02	Analyses of plant specific natural external conditions	I	4
EH03	Man induced external events	II	4
AA	**ACCIDENT ANALYSIS**		
AA01	Scope and methodology of accident analysis	II	4
AA02	QA of plant data used in accident analysis	I	4
AA03	Computer code and plant model validation	II	4
AA04	Availability of accident analysis result for supporting plant operation	I	4
AA05	Main steamline break accident analysis	I	4
AA06	Overcooling transients related to pressurized thermal shock	II	4
AA07	SG collector rupture analysis	II	4
AA08	Accidents under low power and shutdown (LPS) conditions	II	4
AA09	Severe accidents	I	4
AA10	Probabilistic safety assessment (PSA)	I	4
AA11	Boron dilution accidents	I	4
AA12	Spent fuel cask drop accidents	I	4
AA13	ATWS	I	4
AA14	Total loss of electrical power	I	4
AA15	Total loss of heat sink	I	4

Safety issues solution status for the NPPs with VVER-1000 at the Temelín NPP

Ident.	Name of the safety findings	Cat.	State
G	**GENERAL**		
G01	Classification of components	II	4
G02	Qualification of equipment	III	4
G03	Reliability analysis of safety class 1 and 2 systems	II	4
RC	**CORE**		
RC01	Prevention of inadvertent boron dilution	II	4
RC02	Control rod insertion reliability/Fuel assembly deformation	III	4
RC03	Subcriticality monitoring during reactor shutdown conditions	II	4
CI	**COMPONENT INTEGRITY**		
CI01	RPV (Reactor Pressure Vessel) embrittlement and its monitoring	III	4
CI02	Non-destructive testing	III	4
CI03	Primary pipe whip restraints	II	4
CI04	SG collector integrity	III	4
CI05	SG tube integrity	II	4
CI06	Feedwater piping integrity	III	4
S	**SYSTEMS**		
S01	Primary circuit cold overpressure protection	II	4
S02	Mitigation of a SG primary collector break	II	4
S03	Reactor coolant pump seal cooling system	II	4
S04	Pressurizer safety and relief valves qualification for water flow	II	4
S05	ECCS sump screen blocking	III	4
S06	ECCS water storage tank and suction line integrity	II	4
S07	ECCS heat exchanger integrity	II	4
S08	Power operated valves on the ECCS injection lines	I	4
S09	SG safety and relief valves qualification for water flow	III	4
S10	SG safety valves performance at low pressure	II	4
S11	SG level control valves	I	4
S12	Emergency feedwater procedures	I	4
S13	Emergency feedwater system vulnerability	I	4
S14	Ventilation system of control room	II	4
S15	Postaccidental hydrogen removal system	II	4

Ident.	Name of the safety findings	Cat.	State
I&C	**I&C**		
I&C01	I&C reliability	II	4
I&C02	Safety system actuation design	I	4
I&C03	Automatic reactor protection for power distribution and DNB	II	4
I&C04	Human engineering of control rooms	II	4
I&C05	Control and monitoring of power distributions in load follow mode	II	4
I&C06	Condition monitoring for the mechanical equipment	I	4
I&C07	Primary circuit diagnostic systems	II	4
I&C08	Reactor vessel head leak monitoring system	III	4
I&C09	Accident monitoring instrumentation	II	4
I&C10	Technical support center	II	4
I&C11	Water chemistry control and monitoring equipment (primary and secondary)	I	4
EL	**ELECTRICAL POWER**		
EL01	Off-site power supply via startup transformers	I	4
EL02	Diesel generators reliability	I	4
EL03	Protection signals for emergency diesel generators	I	4
EL04	On-site power supply for incident and accident management	II	4
EL05	Emergency battery discharge time	III	4
EL06	Ground faults in DC circuits	I	4
C	**CONTAINMENT**		
C01	Containment by-pass	II	4
IH	**INTERNAL HAZARDS**		
IH01	Systematic fire hazards analysis	II	4
IH02	Fire prevention	III	4
IH03	Fire detection and extinguishing	II	4
IH04	Mitigation of fire effects	II	4
IH05	Systematic flooding analysis	I	4
IH06	Protection against flood for emergency electric power distribution boards	II	4
IH07	Protection against the dynamic effects of main steam and feedwater line breaks	II	4
IH08	Polar crane interlocking	II	4
EH	**EXTERNAL HAZARDS**		
EH01	Seismic design	II	4

Ident.	Name of the safety findings	Cat.	State
EH02	Analyses of plant specific natural external conditions	I	4
EH03	Man induced external events	II	4
AA	**ACCIDENT ANALYSIS**		
AA01	Scope and methodology of accident analysis	II	4
AA02	QA of plant data used in accident analysis	I	4
AA03	Computer code and plant model validation	I	4
AA04	Availability of accident analysis result for supporting plant operation	I	4
AA05	Main steam line break analysis	I	4
AA06	Overcooling transients related to pressurized thermal shock	II	4
AA07	SG collector rupture analysis	II	4
AA08	Accidents under low power and shutdown (LPS) conditions	II	4
AA09	Severe accidents	I	4
AA10	Probabilistic safety assessment (PSA)	I	4
AA11	Boron dilution accidents	I	4
AA12	Spent fuel cask drop accidents	I	4
AA13	Anticipated transients without scram (ATWS)	II	4
AA14	Total loss of electrical power	II	4
AA15	Total loss of heat sink	II	4

State:

1 not yet decided

2 project preparation

3 project implementation

4 solved

ANNEX 3 IAEA and WANO Missions

The annex provides detailed descriptions of international missions for the last three years. The complete list is in Chapter 6.

1. OSART follow – up mission (Dukovany NPP) 2013

In July 2013 OSART follow-up mission took place on Dukovany NPP. The purpose of the mission was to check how the plant responded to the recommendations and suggestions defined in 9 areas during previous OSART Mission (from June 6th to June 23rd 2011).

The Team of Counter partners in 2011 analysed all recommendations and suggestions and prepared a set of corrective measures, responsibilities and the implementation schedule.

Two organisational changes were implemented - in the Safety department and Training department, both of these changes have created conditions for improvements in the areas proposed by OSART missions. Some topics were implemented more broadly than it was defined in the recommendations and suggestions. As an example there is response on suggestion to establish managerial oversight of training. To improve individual managerial oversight input was extended by group supervision on training, and Commission for the training and qualifications of staff were established. Commission's objectives are better use of a systematic approach to training (SAT), internal and external feedback and optimization of training.

OSART Team defined 3 recommendations and 11 suggestions in 2011. Follow-up OSART mission concluded 9 issues as resolved (1 recommendation, 8 suggestions) and 5 issues were ranked as satisfactory progress. At the conclusion of the OSART follow-up mission team leader of the international team Mr. Lipár stated that Dukovany NPP is very well operated nuclear facilities.

2. WANO PEER REVIEW Follow – up mission (Dukovany NPP) 2014

In October 2014 subsequent WANO Peer Review follow-up mission took place on Dukovany NPP. The purpose of the mission was to check how the plant responded to the areas for improvement defined during WANO Peer Review mission in September 2012.

The Team of Counter partners in 2012 analysed all areas for improvement and prepared a set of corrective measures, responsibilities and the implementation schedule.

For 19 areas for improvement team suggested 138 corrective measures. Extraordinary attention was given to three areas highlighted by the team leader in the final summary of the work of experts (staff behaviour including suppliers, feedback not only from the events and emergency preparedness). To the mentioned areas for improvement WANO technical support missions were used as support. Benchmarking in Slovak power plants and EDF Energy in the UK were also used for implementation of observation and coaching methods. After WANO technical support missions aimed at Learning Organization and Emergency Preparedness corrective measures were complemented.

Status of areas for improvement in Final report of WANO Peer Review follow-up mission:

level A – Satisfactory: Most or all of the corrective actions have been completed	5
level B – On Track: Some performance gaps remain	14
level C – At Risk: Little or no performance improvement has been achieved	0
level D – Unsatisfactory: Performance continues to be unsatisfactory	0

Ongoing corrective measures are supervised by the newly formalized permanent working team

MISSION EDU. After a self-assessment of new Performance objectives and criteria WANO (WANO POAC 2013), additional measures will be sequentially completed to ensure preparations for next mission WANO Peer Review, which is scheduled for March 2017.

3. SALTO Peer Review Mission (Dukovany NPP) 2014

November 18. - 27. 2014 a peer review mission send by IAEA on safe long term operation was provided to review Dukovany NPP´s readiness for extended operation behind design lifetime. Team SALTO (Safety Aspects of Long Term Operation) reviewed plant organisation and activities related to long term operation including human resources and knowledge management. The conclusions of this mission are based on comparisons with IAEA safety standards.

The team noticed the following good practices:

- A comprehensive Reactor Pressure Vessel (RPV) surveillance programme;
- System for continuous environment monitoring for equipment qualification needs;
- Implementation of an effective maintenance strategy, according to EPRI methodology

The team identified areas for further improvement:

- Do not provide some assessments of equipment only for a period of 10 years (the first extended licence period), but for the whole period under consideration, i.e. up to 30 years;
- The Ageing Management Review and the Ageing Management Programs for civil structures and more measurements should be performed;
- Coordination between key LTO employees and suppliers, who participates in the preparation of long-term operation, does not ensure that all relevant documents, data and knowledge are being systematically reviewed, archived and shared

Dukovany plant management took the results of the mission and the management has undertaken to implement corrective actions that IAEA will check again at its next mission.

4. WANO PEER REVIEW Follow – up mission (Temelín NPP) 2013

In February 2013 WANO Peer Review follow-up mission took place on Temelín NPP. The purpose of the mission was to check how the plant responded to the suggestions defined during WANO Peer Review mission in November 2011 in expert areas.

Team for the preparation of mission at Temelín NPP has prepared an action plan and submitted system corrective measures, prepared specific tasks and the overall implementation schedule. In the 17 proposals for improvement existing processes were prepared a total of 62 corrective actions. The mentioned proposals for improvement were, among others, used as support in the form of WANO technical support missions.

Status of proposals for improvement in Final report of WANO Peer Review follow-up mission:

level A – Satisfactory: Most or all of the corrective actions have been completed	2
level B – On Track: Some performance gaps remain	13
level C – At Risk: Little or no performance improvement has been achieved	2
level D – Unsatisfactory: Performance continues to be unsatisfactory	0

5. Corporate OSART mission (ČEZ, a. s.) 2013

The first Corporate Operational Safety Review Team (OSART) mission of international experts visited the Czech Corporate organization ČEZ, a. s. from 29 September to 09 October 2013. A team of experts reviewed the management of the company ČEZ, a. s. in seven areas: Corporate Management; Organization and Management, Independent Oversight; Human Resources; Communication; Maintenance; Technical support; and Procurement. OSART team defined 3 recommendations and 6 proposals for improvement:

- The corporate organization shall organize the areas of management as an integrated level for the processes connected with activities important for nuclear safety and radiation protection.
- The corporate independent oversight should be extended to cover all corporate functions with potential impact on nuclear safety.
- The corporate organization should reinforce its plant modifications process to ensure that management of temporary modifications is conducted in a safe, reliable and effective manner.
- The corporate organization should improve the way to conduct the reviews of activities connected with safety in the management system by systematically reviewing efficiency.
- Consideration should be given by corporate management to strictly follow the procedures for the organizational changes to ensure that the safety assessment is performed in the initial phase.
- The organization should consider developing a program which reinforces management's involvement in observation and evaluation of training.
- The corporate organization should consider developing a strategic planning policy and system of training personnel for the NPPs to address future needs.
- The corporate organization should consider the sharing of good practices between both NPP sites and cross-training of the NPP sites communication staff.
- The corporate organization should consider clearly defining its process for configuration management, and consistently apply its elements.

OSART team found ten good practices too:

- Approach that enhances the timeliness and accuracy of regulatory and legislative safety related requirements evaluation and implementation.
- ARIS SW Tool Process Management Support in ČEZ, a. s.
- Safety Portal on the Intranet ČEZ, a. s. Group
- Strategic recruitment - Talent Acquisition process, psychological diagnosis
- Nuclear Knowledge Transfer and Retention Program (Knowledge management)
- Social Media – Facebook, Twitter, YouTube
- Education Program World of Energy
- KPV software for optimization of maintenance.
- Extended scope of Nuclear Fuel Fabrication Data
- Nuclear Fuel Quality Control and Inspection performed by Third Party

6. OSART follow – up mission (Temelin NPP) 2014

In May 2014 OSART follow-up mission took place on Temelín NPP. The purpose of the mission was to check how the plant responded to the suggestions defined during OSART mission in November 2012 in eight expert areas.

Team for the preparation of mission at Temelín NPP has prepared an action plan and submitted system corrective measures, elaborated specific tasks and the overall implementation schedule.

Follow-up OSART mission concluded 5 issues as resolved and 6 issues were ranked as satisfactory progress. At the conclusion of the OSART follow-up mission team leader of the international team Mr. Gest stated that Temelín NPP is very well operated nuclear facilities.

7. WANO Peer Review mission (ETE) 2015

In December 2015 mission WANO Peer Review was held at Temelín. It was the first mission in Czech plants performed in accordance with the new Performance objectives and criteria. 14 areas for improvement have been identified:

1x in area “Nuclear professionals”
2x in area “Operations”
3x in area “Maintenance”
2x in area “Chemistry”
1x in area “Training”
1x in area “Performance improvement”
1x in area “Operating experience”
1x in area “Organisational effectiveness”
1x in area “Manager fundamentals“
1x in area “Emergency preparedness”

And 3 strengths too:
1x in area “Chemistry”
1x in area “Radiological protection”
1x in area “Emergency preparedness”

8. Corporate OSART Follow-up visit (ČEZ, a. s.) 2015

An IAEA Corporate Operational Safety Review Follow-up Team visited ČEZ, a. s. Headquarters from 18. - 22. May 2015. Its objective was to assess progress in solving the recommendations and suggestions from the previous mission. One recommendation (Oversight and reporting do not cover all Corporate functions important to safety) and 5 suggestions (Efficiency review of activities connected with safety, Important changes prepared without input from safety sections, Training observation and evaluation programme, Succession planning process, Sharing of good practices) were rated as resolved and the remaining two recommendations and one suggestion were rated as “satisfactory progress of solution”.

ANNEX 4 Case of Welds

SÚJB
Státní úřad pro jadernou bezpečnost

CASE OF WELDS

ANALYSIS OF WEAKNESSES
IN THE PERFORMANCE OF NDT INSPECTIONS
AT CZECH NUCLEAR POWER PLANTS

APRIL 2016

CASE OF WELDS: Analysis of weaknesses in the performance of NDT inspections at Czech nuclear power plants

Issued by: State Office for Nuclear Safety, Prague, April 2016
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1. INTRODUCTION

During the second half of 2015, significant weaknesses in the performance of non-destructive testing (NDT) became evident at both nuclear power plants, which are currently in operation in the Czech Republic,: Dukovany Nuclear Power Plant, with four VVER 440/213 type units (hereinafter referred to as the "Dukovany NPP") and Temelín Nuclear Power Plant, with two VVER 1000/320 type units (hereinafter referred to as the "Temelín NPP"). The company ČEZ, a. s., is the holder of the operating licence for these NPPs.

Identified weaknesses directly resulted in temporary shutdown of Dukovany NPP Units 2 and 3, and in significant extension of outage on Dukovany NPP Unit 1, which at that time was in shutdown conditions for the purposes of refuelling. As for the remaining units at Dukovany and Temelín NPPs, it was possible to remove weaknesses during following planned outages.

As to the date of this information preparation, not all aspects of the case have been finalized.

2. FACTS

By the letter dated 8 September 2015, the company ČEZ, a. s., informed the SÚJB that it had identified weaknesses in non-destructive testing of welded joints on classified SSCs of the Dukovany NPP, stating:
"...In connection with a leak in a heterogeneous weld in the emergency feedwater pipe of steam generator (SG) No. 43 at Dukovany NPP in this year (note: 06/2015), an radiograph of poor quality taken during inspection carried out on 1 December 2014 was identified in the framework of investigation of this event. On the basis of this information, all radiographs taken for heterogeneous welds on all SGs at Dukovany NPP since 2008 (i. e. within the current period of the in-service inspection program) were subsequently checked. Due to the fact that another radiographs showing a lower quality have been found..."

ČEZ, a. s., decided to shut down Dukovany NPP Units 2 and 3, and to check other radiographs. At that time, Dukovany NPP Unit 1 was in planned outage. In the case of Dukovany NPP Unit 4, the company ČEZ, a. s., forwarded its statement of reasons for further operation to the SÚJB demonstrating that it can be safely operated until following planned outage, although radiographs of poor quality have been found there, too.

In the period from September 2015 to January 2016, the company ČEZ, a. s., ensured that the radiographs of welds were re-evaluated on safety systems and defects found on those welds, which are essential to assure nuclear safety were removed. After completing these activities, Dukovany NPP Units 1, 2 and 3 were put back into operation.

Radiographs of poor quality have been found in both nuclear islands, nuclear and non-nuclear, of Dukovany NPP. Overwhelming majority of them was on small diameter process measurement piping Findings do not apply to the most important components such as reactor pressure vessel or pressurizer. In terms of nuclear safety assurance, the most serious were the weaknesses in radiographs as well as welds on emergency SG feedwater piping.

On the basis of the findings at Dukovany NPP, the company ČEZ, a. s., re-evaluated the radiographs also at Temelín NPP. Weaknesses in the quality of radiographs and welded joints themselves have been identified even there. In terms of nuclear safety assurance, the situation at Temelín NPP is less serious than at Dukovany NPP because the relevant welded joints are additionally inspected by another non-destructive testing, the results of which demonstrate the adequate quality of the relevant welded joints. Despite this, it was necessary to re-evaluate also a large number of radiographs at Temelín NPP and repairs will have to be made on some welded joints.

Uncertainties as to the condition of welds resulted in the absence of information regarding the actual state of nuclear installation as a whole, thereby constituting a breach of the requirement to be aware of the actual state of installation throughout the operation of nuclear installation and to have nuclear installation under control.

3. MEASURES

The SÚJB initiated the administrative procedure with the party to the procedure – ČEZ, a. s. The outcome was the decision to impose implementation of remedial measures. That means, to implement measures to remedy discrepancies concerning the welded joints on classified SSCs of all units of Dukovany NPP as well as to provide sufficient human resources necessary for the performance and evaluation of non-destructive testing and, if such testing is performed by suppliers, to provide sufficient own (from the ČEZ, a. s., side) human resources necessary for the verification of the results of such testing.

The company ČEZ, a. s., has examined the existing records – thousand of records in total – of the order of 13,000 records at Dukovany NPP and 8,500 at Temelín NPP.

Safety assessment was carried out for all nuclear units – i.e. four at Dukovany NPP and two at Temelín NPP - to assess the state of nuclear equipment with identified deficiencies demonstrating that even if any weakness is identified, it is possible to operate units safely until dates for settlement of deficiencies.

If any impossible-to-evaluate radiographs were identified by this inspection, new radiographs were taken. Any indications of defects in welded joints were remedied during outage.

This case also affected the process of issuing the licence for further operation of Dukovany NPP Unit 1.

4. INSPECTIONS FINDINGS BY SÚJB

In the framework of its inspection aimed at the issues related to heterogeneous welded joints, which took place from April to August 2015, the SÚJB found anomalies in the processes of X-ray inspections.

Among other things, the inspection dealt with leaks in the heterogeneous weld in an emergency feedwater pipe of steam-generator No. 43, which ultimately forced the company ČEZ, a. s., to submit information described above in Chapter 2.

The inspection mentioned above has identified weaknesses in documentation and weaknesses in supervision by ČEZ, a. s., of the activities carried out by a supplier for maintenance of nuclear equipment, specifically of the inspections of heterogeneous welded joints on classified SSCs at Dukovany NPP. It stated a breach of a number of the provisions of the Atomic Act and its implementing legal regulations, which require, for example, that the so-called “special processes” (including welding) be carried out by qualified persons and with the use of technical equipment, which is subject to periodic control of compliance with requirements for special processes.

Further, they require that the so-called “non-conformity management process” be carried out in order to remedy and prevent from recurring any non-conformities in processes and activities with the requirements laid down in documentation.

They also impose an obligation to review processes and activities in the quality system in order to verify suitability, adequacy and effectiveness of any item affecting nuclear safety.

Last but not least, the requirements laid down by the Decree define that quality assurance of classified SSCs must include the keeping of records documenting compliance with the quality requirements of classified SSCs to the extent and in a way making it possible to assess the state of classified SSCs at any time.

SÚJB inspectors continue to verify the situation in the framework of other inspections underway.

The whole case provides also lessons for the SÚJB and the efficiency analysis is carried out for inspections and internal procedures.

5. ČEZ, a. s.

Causes of the weaknesses on the part of ČEZ, a. s., are rather of a systematic nature.

They include excessive satisfaction with the favourable assessment for both nuclear installations, in particular Dukovany NPP, even on an international basis, e.g. in the framework of a number of reports and conclusions from missions carried out by IAEA or WANO.

Further, prevailing is the emphasis placed on technical aspects of operation at the expense of the interest in personnel leading and management and cooperation between particular organizational units with a little emphasis placed by top management on enforcement of appropriate behaviour.

Non-conceptual efforts to reduce costs had also influence.

6. CONCLUSION (AS AT 30 APRIL 2016)

At present, the situation at both nuclear power plants is as follows.

All the weaknesses identified at Dukovany NPP Unit 1 were remedied and the administrative procedure to authorize operation for a further period was terminated by issuing a decision authorizing further operation of Dukovany NPP Unit 1 on 30 March 2016.

Similarly, serious weaknesses were remedied on Dukovany NPP Units 2 and 3, with the work on less relevant systems continuing in planned outages of these units in this year.

Dukovany NPP Unit 4 is currently in planned outage, which is longer than normally due to the need to remedy deficiencies in documentation for welded joints and welds themselves.

Temelín NPP units will be put into planned outages in summer months 2016. Repeated inspections of welds, radiographs of which did not show a sufficient quality, take place, where possible, in operation of units and, where impossible, will take place during outages in 2016 and 2017 (while applying a graded approach by relevance of particular classified SSCs); the duration of outages will be probably thus extended depending on the number of the weaknesses identified in welded joints themselves.

The amount of loss stated by ČEZ, a. s.,in connection with the presented case is CZK 2.5 billion for 2015. In this context, two criminal complaints were also filed by both ČEZ, a.s., and SÚJB.

At the same time, the SÚJB notified the Association for Personnel Certification (APC), as an independent certification body for NDT testing personnel, in the matter of qualification verification for personnel, who carried out the X-ray tests in question.

The SÚJB also defined a list of requirements aimed at addressing the causes of the case in the form of conditions to the licence within the frame of licence issuance for further operation of Dukovany NPP Unit 1.

7. USED ABBREVIATIONS

Atomic Act	*Act No. 18/1997 Coll., on Peaceful Utilisation of Nuclear Energy and Ionising Radiation, as amended*
ČEZ, a. s.	Business name of the Czech utility - joint stock company ČEZ, a. s.
EDU/ Dukovany NPP	Dukovany Nuclear Power Plant
Temelín NPP	Temelín Nuclear Power Plant
IAEA	International Atomic Energy Agency
RTG	Radiographs
SSCs	Structures, systems and components
SÚJB	State Office for Nuclear Safety
WANO	World Association of Nuclear Operators

ANNEX 5 List of Legislative Regulations Dealing with Nuclear Energy and Ionizing Radiation and Related Documents

ATOMIC ACT AND RELATED IMPLEMENTING DECREES

Act No. 18/1997 Coll*.,* on peaceful utilisation of nuclear energy and ionising radiation (the Atomic Act) and on Amendments and Alterations to Some Acts as amended by Act No. 83/1998 Coll., Act No. 71/2000 Coll., Act No. 132/2000 Coll., Act No. 13/2002 Coll., Act No. 310/2002 Coll., Act No. 320/2002 Coll., Act. No. 279/2003 Coll., Act No. 186/2004 Coll., Act. No. 1/2005 Coll., Act No. 253/2005 Coll., Act No. 413/2005 Coll., Act No. 186/2006 Coll., Act. No. 342/2006 Coll., Act. No. 296/2007 Coll., Act. No. 124/2008 Coll., Act. No. 189/2008 Coll., Act. No. 247/2008 Coll., Act. No. 158/2009 Coll., Act. No. 223/2009 Coll. , Act. No. 227/2009 Coll., Act. No. 249/2011 Coll., Act. No. 250/2011 Coll., Act No. 375/2011 Coll., Act. No. 350/2012 Coll., Act. No. 64/2014 Coll. and Act. No. 250/2014 Coll.

- ***SÚJB Decree No. 144/1997 Coll.***, on physical protection of nuclear materials and nuclear facilities and their classification, as amended by the SÚJB Decree No. 500/2005 Coll.;
- ***SÚJB Decree No. 146/1997 Coll***., specifying activities directly affecting nuclear safety and activities especially important from radiation protection viewpoint, requirements on qualification and personnel training, on methods to be used for verification of special professional competency and for issue authorisations to selected personnel, and the form of documentation to be approved for the licensing of expert training of selected personnel, as amended by the SÚJB Decree No. 315/2002 Coll.;
- ***SÚJB Decree No. 215/1997 Coll**.,* on criteria for siting of nuclear installations and very significant ionizing radiation sources;
- ***SÚJB Decree No. 106/1998 Coll**.,* on nuclear safety and radiation protection assurance during commissioning and operation of nuclear facilities;
- ***Government Order No. 11/1999 Coll***., on emergency planning zone;
- ***SÚJB Decree No.195/1999 Coll.,*** on basic design criteria for nuclear installations with respect to nuclear safety radiation protection and emergency preparedness;
- ***SÚJB Decree No. 307/2002 Coll***., on radiation protection, as amended by the SÚJB Decree No. 499/2005 Coll. and SÚJB Decree No. 389/2012 Coll.;
- ***SÚJB Decree No. 317/2002 Coll***., on type-approval of packaging assemblies for transport, storage and disposal of nuclear materials and radioactive substances, on type-approval of ionizing radiation sources and on transport of nuclear material and specified radioactive substances ("on type approval and transport"), as amended by the SÚJB Decree No. 77/2009 Coll.;
- ***SÚJB Decree No. 318/2002 Coll***., on details of emergency preparedness of nuclear facilities and workplaces with ionizing radiation sources and on requirements on the content of on-site emergency plan and emergency rule, as amended by the Decree of the SÚJB No. 2/2004 Coll.;
- ***SÚJB Decree No. 319/2002 Coll***., on performance and management of the National Radiation Monitoring Network, as amended by the Decree of the SÚJB No. 27/2006 Coll.;

- ***SÚJB Decree No. 360/2002 Coll.,*** laying down the method on formation of the reserves ensuring a decommissioning of nuclear installations or Type III or IV workplaces;

- ***Government Order No. 416/2002 Coll.,*** established details concerning the amounts and method of payment of contributions to the nuclear account by generators of radioactive waste and provides for the annual administration of these resources as amended by Government amended Government Regulation no. 46/2005 Coll., and Government Regulation no. 341/2009 Coll., Government Decree no. 461/2011 Coll., Government Decree no. 337/2015 Coll;

- ***SÚJB Decree No. 419/2002 Coll.,*** on personal radiation passports;

- ***SÚJB Decree No. 185/2003 Coll.,*** on decommissioning of nuclear installation or workplaces of category III or IV;

- ***SÚJB Decree No. 309/2005 Coll.,*** on assurance of technical safety of selected equipment;

- ***SÚJB Decree No. 461/2005 Coll.***, on the process for providing subsidies intended for the introduction of measures leading to a reduction exposure from natural radionuclides in the indoor air of buildings and a reduction of natural radionuclide concentration in drinking water appointed for public supply;

- ***SÚJB Decree No. 462/2005 Coll.,*** on distribution and collection of detectors intended for identification of buildings with an icreased level of exposure to natural radionuclides and on conditions for acquirement of state budget subsidy;

- ***SÚJB Decree No. 132/2008 Coll.,*** on Quality Assurance System in carrying out activities connected with utilization of nuclear energy and radiation protection and on Quality assurance of selected equipment in regard their assignment to classes of nuclear safety;

- ***Government Order No. 73/2009 Coll.,*** on information exchange related to the international transport of radioactive waste and spent fuel;

- ***SÚJB Decree No. 165/2009 Coll.,*** laying down a list of trigger items;

- ***SÚJB Decree No. 166/2009 Coll.,*** laying down a list of nuclear - related dual-use items. ;

- ***SÚJB Decree No. 213/2010 Coll.,*** on accountancy and control of nuclear materials and reporting of data required by laws of the european communities;
- ***Government Order No. 399/2011 Coll.,*** on fees for professional activities of the State Office for Nuclear Safety;

- ***Government Order No. 341/2009 Coll.,*** about the amount of payment and transfer to the nuclear account by radioactive waste producers and about the annual subsidy to the communities and the rules for its takedown.

MULTILATERAL INTERNATIONAL TREATIES AND TREATIES WITH IAEA

Part of the valid Czech legislation in the given area includes the following international treaties signed by the Czech Republic (or the former Czechoslovak Socialistic Republic and later the Czech and Slovak Federal Republic):

- The Convention on the Physical Protection of Nuclear Materials (in Vienna on October 26, 1979, communication of Ministry of Foreign Affairs No. 27/2007 Coll.);

- The Convention on Early Notification of a Nuclear Accident (in Vienna on September 26, 1986, communication of Ministry of Foreign Affairs No. 116/1996 Coll.);

- The Convention on Assistance in the Case of a Nuclear or Radiation Accident (in Vienna on September 26, 1986, communication of Ministry of Foreign Affairs No. 115/1998 Coll.) ;
- Nuclear Safety Convention (in Vienna on June 17, 1994, communication of Ministry of Foreign Affairs No. 67/1998 Coll.);
- Vienna Convention on Civil Liability for Nuclear Damage (in Vienna on May 21, 1963, ratified, communication of Ministry of Foreign Affairs No. 133/1994 Coll., communication of Ministry of Foreign Affairs No. 125/2000 Coll.);
- The Joint Protocol relating to the Application of the Vienna and Paris Conventions on Liability for Nuclear Damage (in Vienna in 1988, ratified, communication of Ministry of Foreign Affairs No. 133/1994 Coll.);
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radiological Waste Management (in Vienna on September 30, 1997, Government resolution No. 593/1997, ratified on March 26, 1999);
- The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) (Decree by Ministry of Foreign Affairs No. 61/1974 Coll., of March 29, 1974);
- The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, February 25, 1991, ratified on February 26, 1991, communication of Ministry of Foreign Affairs No. 91/2001 Coll.);
- Convention on Access to Information, Public Participation in Decision–Making and Access to Justice in Environmental Matters (Aarhus, Denmark, 1998, ratified on October 4, 2004, communication of Ministry of Foreign Affairs No. 124/2004 Coll.);
- The Convention on Korean Energetics Development Organization (KEDO) – letter of Ministry of Foreign Affairs on acceptance of the Agreement of March 9, 1995 and of the supplemental Protocol of 1997 by the Czech Republic dated January 27, 1999; the Czech Republic became a member on February 9, 1999;
- 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 18, 1996, communication of Ministry of Foreign Affairs No. 68/1998 Coll.);
- The 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, communication of Ministry of Foreign Affairs 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, communication of Ministry of Foreign Affairs No. 509/1990 Coll.);
- International Labour Organization Convention (No. 115) Concerning the Protection of Workers Against Ionising Radiation (Geneva, June 22, 1960, through communication of the MZV No. 465/1990 Coll.);
- Comprehensive Nuclear Test Ban Treaty (has not yet entered into force, signed by the Czech Republic in November 12, 1996 and ratified in September 11, 1997);
- The Protocol on Amendment to the Vienna Convention on Civil Liability for Nuclear Damage (in Vienna on September 12, 1997, signed by the Czech Republic in June 18, 1998, however it has not been ratified yet). 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;

- The 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).

SELECTED ACTS CONCERNING THE SÚJB

- ***Act No. 500/2004 Coll.,*** *Code of Administrative Procedure, as amended;*
- ***Act No. 634/2004 Coll.,*** *on Administrative Fees, as amended;*
- ***Act No. 255/2012 Coll.,*** *on Inspection (Inspection Code), as amended;*
- ***Act No. 281/2002 Coll.,*** *on some measures related to prohibition of bacteriological (biological) and toxin weapon, as amended;*
- ***Act No. 19/1997 Coll.,*** *On Some Measures Concerning Chemical Weapons* Prohibition*, as amended;*
- ***Act No. 106/1999 Coll.,*** *on free access to information, as amended;*
- ***Act No. 123/1998 Coll.,*** *on the right to information on environment, as amended;*
- ***Act No. 100/2001 Coll.,*** *on Environmental Impact Assessment, as amended*
- ***Act No. 594/2004 Coll.,*** *of implementing the European Community regime for the control of exports of dual-use items and technology , as amended;*
- ***Act No. 183/2006 Coll.,*** *on town and country planning and building code (Building Act), as amended;*
- ***Act No. 111/1994 Coll.,*** *on Road Transport, as amended;*
- ***Act No. 373/2011 Coll.,*** *on Specific Medical Services, as amended;*
- ***Act No. 505/1990 Coll.,*** *on Metrology, as amended;*
- ***Act No. 412/2005 Coll***., *on the Protection of Classified Information* , as amended.

EMERGENCY LEGISLATION

- ***Constitutional Act No. 110/1998 Coll***., on the security of the Czech Republic, as amended by Constitutional Act No. 300/2000 Coll.;
- ***Ministry of Interior Decree No. 328/2001 Coll***., on certain details of providing of integrated emergency system, as amended by the Decree No. 429/2003 Coll.;
- ***Act No. 239/2000 Coll***., on Integrated Rescue System and on Amendment to Certain Related Acts, 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 hazardous chemicals or chemical mixtures and amending Act no. 634/2004 Coll., on administrative fees, as amended (the Act on prevention of major accidents);
- ***Act No. 412/2005 Coll***., on Classified Information Protection and on Security Capacity, as amended.

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 2016 can be found on SÚJB website:

http://www.sujb.cz/en/reports/the-czech-republic-national-report-under-the-convention-on-nuclear-safety-2016/

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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, a.s, which was established in 1955, and its subsidiary company Research Centre Rez, Ltd. A significant part of the experimental base has been research reactors. With the aim 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 Research Centre Řež Ltd. that fulfils the conditions for financing from governmental sources.

Based on the Act on state-governed surveillance of Nuclear Nafety (issued in 1984), the research reactors have been subject to 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 (SÚJB), 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.

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 SÚJB Decree No. 9 of 1985. The IAEA recommendations issued in 2003 and operational experience from research reactors in the Czech Republic and worldwide were used in its preparation.

Operators of all nuclear research installations, in accordance with IAEA recommendations perform internal self-assessment of safety of research reactors and other facilities and regularly inform SÚJB on operational results and events based on agreements.

Overview of research reactors

LVR-15 Research Reactor in Research Centre Řež

The construction of the reactor originally called VVR-S was 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, to 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 transition to three-week campaign.

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 the present time, 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, to produce radio-pharmaceutical isotopes, to 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 the neutron capture therapy for brain tumours. This project was interrupted due to a lack of the funds.

In 2006, the programme of ageing management of selected reactor components was initiated and focused on extending of operating lifetime of the research reactor after 2014. In 2010, the management of the Institute has decided that these activities will be focused on the year 2028. This intention is supported by very good operational results of reactor LVR-15, the results of last five-year cycle of operational inspections in 2007 and the results of the programme of ageing management.

Since 2005, the Czech Republic has joined to global initiative of the USA, Russia and IAEA GTRI (Global Thread Reduction Initiative) whose objective is 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 back 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 enrichment of 19.7% is currently used in the reactor.

At the end of 2014, the LVR-15 reactor protection and control system was renovated on the basis of the authorization issued by the SÚJB, which included installation of a new modern digital reactor control and protection system.

In 2010, was started production of 99Mo by irradiating samples containing uranium enriched to 89 – 93% U235 in the LVR-15 reactor. First irradiation of low-enriched targets for the production of 99Mo on the LVR-15 reactor was realized in September 2015. A total amount of 24 targets were irradiated within the test irradiation project until April 2016. Commercial irradiation is planned in connection putting into operation the processing line from Belgian partner inMay 2016. Planned gradual increase in the production of low-enriched targets for the production of 99Mo will reduce the existing production of high-enriched targets on the LVR-15 reactor.

Implementation of new experimental loops to the reactor is planned in the following years. 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) is planned. The loop is an experimental facility with closed, forced water circulation, whose active channel will be part of the LVR-15 research reactor. The loop will be intended for research in the field of supercritical water. It is a general-purpose facility with the aim at 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 upcoming 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.

The SÚJB licensed the operation of the LVR-15 reactor to the Research Centre Řež Ltd.., in 2010, with validity until 31 December 2020.

LR-0 Critical Assembly in in Research Centre Řež Ltd.

The LR-0 critical assembly LR-0 was created by reconstructing the heavy-water TR-0 critical assembly, which was constructed in Rež and most of its equipment was manufactured in the former Czechoslovakia. The reactor was used to perform research on 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.

In connection with transition of the Czechoslovak nuclear program to NPPs with VVER pressurized water reactors, the TR-0 was reconstructed to theLR-0 experimental light water reactor with zero power output. Physical start-up of the LR-0 reactor took place on December 19, 1982 and the reactor was put into continuous operation in 1983. 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 by moderator level.

s part of modernization of the LR-0 reactor, the I&C system was innovated to digital version, with a strict separation of operating and safety systems. Innovation was carried out between 2007 and 2008, on the basis of SÚJB license of 17 September 2007.

Two configuration changes in reactor core with consecutive basic critical experiment on the LR-0 reactor were made in July 2015 and subsequently in January 2016 on the basis of SÚJB license.

The SÚJB licensed operation of the LVR-0 reactor to the Research Centre Řež Ltd., in 2010, with validity until 31 December 2020.

VR-1 Training Reactor at ČVUT - FJFI

The VR-1 training reactor was commissioned on December 3, 1990 at ČVUT-FJFI (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 the former Czechoslovakia. The reactor is used in the training process of university students, in the scientific activities and for needs to prepare specialists of the Czech nuclear power programme. The VR-1 training reactor participates in international cooperation (TEMPUS, ENEN and NEPTUNO programs) within close relationship with similar training reactors in UK, Netherlands and Austria.

In October 2005, the 36% enriched fuel (HEU) of VR-1 reactor was exchanged for fuel enriched below 20% (LEU). The VR-1 reactor became the first reactor with IRT 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 reactor with the electronic recording function for shift operationalinspections took place in summer 2011.

Reconstructions of the support structures for demineralization station in the VR-1 reactor hall took place during the summer outage in 2014.

Two projects took place during the summer outage 2015 - innovation of the tubular post system and the moderator circulation system in the H02 tank.

The SÚJB granted the licenced for operation of the VR-1 reactor to the Czech Technical University in 2007, with validity until the end of 2017.

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. 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 in compliance with IAEA recommendations – “Safety requirements for research reactor” (NS-R-4) and “Code of conduct on safety of research reactors” and with other existing and being prepared Safety Standards for the research reactors.

Annex 9 National Action Plan on Strengthening Nuclear Safety of Nuclear Facilities in the Czech Republic

An update of the Action Plan of the Czech Republic has been prepared, which reflects the results of the peer reviews of the Action Plans organized by the ENSREG in April 2013 as well as the outcomes of the negotiations between ČEZ, a. s., and SÚJB. The Action Plan of the Czech Republic is a live document, which will be revised and continuously updated taking into account the latests state of knowledge.

Revision 2 in the Czech language can be found here:

http://www.sujb.cz/fileadmin/sujb/docs/jaderna-bezpecnost/Cesky_NAcP_Rev2_final.pdf

Revision 2 in the English language can be found here:

http://www.sujb.cz/fileadmin/sujb/docs/jaderna-bezpecnost/Czech_National_Action_Plan_rev2.pdf

From the history of preparation:

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, 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-section issues.
- Part IV includes a list of measures aimed at implementing all recommendations contained in Parts I-III. This is a summary of corrective actions identified during periodic safety assessment of Dukovany NPP and Temelín NPP after twenty respectively 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.

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 administration bodies, in particular SÚJB and relevant ministries.

LAST PAGE

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