# *Czech Republic*

# *National Report*

## *for the purpose of the*

# *Nuclear Safety Convention*


**Revision 2001**

# Table of Contents

# Introduction

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 fulfillment of obligations arising from the Convention by the Czech Republic by 31 June 2001. The structure of the 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".

By the above-mentioned date the Czech Republic had one operating nuclear installation covered by the Convention on Nuclear Safety and owned by Czech power utility - ČEZ, a.s .: NPP Dukovany with four reactor units of VVER-440/213 type. The units were commissioned in the following years:

- 1st unit - 1985,
- 2nd unit - 1986,
- 3rd unit - 1987,
- 4th unit - 1987.

Further there are two reactor units VVER 1000/320 at the Temelín site, with Unit 1 in the commissioning stage and Unit 2 before the commissioning start.

The National Report reports on the state of implementation of individual Articles of the Convention and considers only the two above-mentioned nuclear installations. Nevertheless, the basic philosophy and principles of nuclear safety assurance applied to these two nuclear power plants have been correspondingly applied also to the other nuclear installations in the Czech Republic - three research reactors, Interim Spent Fuel Storage Facility and Radioactive Waste Repository. The last two nuclear installations will be, with regard to their nature, subject to evaluation under the separate Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

# List of Abbreviations

| | |
|---|---|
| **ADR** | European treaty on transport of hazardous goods |
| **ANS** | American Nuclear Society |
| **ANSI** | American Nuclear Standard Institute |
| **AQG** | Atomic Question Group |
| **ASSET** | Assessment of Safety Significant Events Team |
| **BOZP** | Industrial safety |
| **BRS** | National Security Board |
| **CDF** | Core Degradation Frequency |
| **CTP** | Technical Support Center |
| **ČEZ, a.s.** | Business name of the Czech utility - joint-stock company ČEZ, a.s. |
| **ČEZ-EDU** | ČEZ, a.s., nuclear power plant Dukovany |
| **ČEZ-ETE** | ČEZ, a.s., nuclear power plant Temelín |
| **ČHMÚ** | Czech Hydrometeorology Institute |
| **ČSFR** | Czech and Slovak Federal Republic |
| **ČSKAE** | Czech Commission for the Atomic Energy |
| **ČSSR** | Czechoslovak Socialist Republic |
| **ČÚBP** | Czech Institute for Labor Safety |
| **EGP** | Energoprojekt Praha |
| **EOP** | Emergency Operation Procedure |
| **HP** | Emergency preparedness |
| **HPES** | Human Performance Evaluation System |
| **ICAO** | International Civil Aviation Organization |
| **ICRP** | International Commission for Radiation Protection |
| **INES** | International Nuclear Event Scale |
| **INEX** | International Exercise |
| **INPO** | Institute of Nuclear Power Operators |
| **INSAG** | International Nuclear Safety Advisory Group |
| **IPERS** | ”International Peer Review Service |
| **IRRT** | International Regulatory Review Team |
| **IRS** | Incident Reporting System |
| **ISO** | International Standard Organization |
| **ITI** | Institute of Technical Inspections |
| **KI** | Potassium iodide |
| **KKC** | Emergency Coordination Center |
| **KP** | Controlled zone |
| **LaP** | Limits and conditions/technical specifications |
| **LRF** | Large Break Frequency |
| **MAAE** | International Atomic Energy Agency |
| **MPO** | Ministry of the industry and Trade of the Czech Republic |
| **MSK-64** | Medvedev Sponheuer Karnik (seismic intensity scale) |
| **MSVP** | Interim Spent Fuel Storage |
| **NATO** | North Atlantic Treaty Organization |
| **NUSS** | Nuclear Safety Series |
| **OECD-NEA** | Energy agency of the Organization for economic cooperation and development |
| **OkÚ** | District office |

| | |
|---|---|
| **OSART** | Operational Safety Review Team |
| **PHARE** | Technical assistance program organized by the European Commission |
| **PO** | Fire protection |
| **POO** | Sub-committee for population protection |
| **PRIS** | Power Reactor Information System |
| **PSA** | Probabilistic Safety Assessment |
| **PSCO** | Civil defense working group |
| **PWR** | Pressurized Water Reactor |
| **QARAT** | Quality Assurance Review Assistance Team |
| **RÚ CO** | Regional office of civil defense |
| **SAMG** | Severe Accident Management Guidelines |
| **SAS** | Safety Advisory System |
| **SSSR** | Union of the Soviet Socialist Republics |
| **SÚJB** | State Office for Nuclear Safety |
| **SÚRAO** | Administration of Radioactive Waste Repositories |
| **SÚRO** | State Institute for Radiation Protection |
| **ŠVS** | Education and Training Center |
| **ÚJV Řež** | Nuclear Research Institute in Řež u Prahy |
| **UKŠ** | Central Emergency Staff |
| **US NRC** | US Nuclear Regulatory Commission |
| **VCNP** | Committee for civil emergency planning |
| **VI ČEZ** | Production Inspection of ČEZ, a.s. |
| **VKRH** | Governmental commission for radiation accidents |
| **VKRH** | Governmental commission got radiation accidents |
| **VÚJE** | Research Institute for Nuclear Power Plants |
| **VVER (or WWER)** | Type identification for pressurized water reactors designed in the former Soviet Union |
| **WANO** | World Association of Nuclear Operators |
| **WDPF** | Westinghouse Distributed Processing Family |
| **WENRA** | Western Nuclear Regulatory Association |
| **WPNS** | Working Party on Nuclear Safety |
| **ZHP** | Emergency planning zone |

# 1. Existing nuclear installations - Article 6 of the Convention

*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.*

## 1.1 Description of the current situation

### 1.1.1 Existing nuclear installations in the Czech Republic as defined in Article 2 of the Convention

At present there are four VVER-440/213 reactor units operated in the Czech Republic of the nuclear power plant (hereinafter NPP) Dukovany. Further, there are two reactor units VVER-1000/320 at the Temelín site, while Unit 1 is in the commissioning stage and Unit 2 before the commissioning start. Geographic locations of both the Czech nuclear power plants are shown in Fig. 1-1. Diagrams of both the plants, technical data and hitherto changes in their designs can be found in Appendix 1 to this National Report.

### 1.1.2 NPP Dukovany

#### 1.1.2.1 Overview of nuclear safety assessments performed and their main conclusions

Evaluation of the nuclear safety assurance level at NPP Dukovany has been under way practically since the very beginning of its construction in 1976. First analyses after the units were put into operation, and especially analyses performed in response to the Chernobyl accident, resulted in the project of the so-called ”Back-fitting of Nuclear Power Plant Dukovany”.

Since the early 1990s a major attention has been paid to the safety reassessment of units with VVER 440/213 reactors, through analyses, support programs and various international activities. These efforts include in particular:

- assessment of conclusions from OSART and ASSET missions, assessment of safety findings, IPERS
- supporting analyses performed within international technical cooperation projects
- exchange of experience from operation within WANO, mission "Peer Review
- common activities by operators of units with VVER 440/213 reactors
- technical audits (internal, external)
- probabilistic safety assessment ( PSA study level 1)
- safety assessment of NPP Dukovany units after 10 years of operation
- assessment by insurance pools
- assessment by WENRA
- periodic safety assessment

The following text briefly describes the goals, scope and main results of the performed assessments. Results of the assessments have been translated into short-term or medium-term measures or, in the long-term prospective, they have been used as input data for the extensive project called ”Modernization Program for NPP Dukovany”.

***IAEA Mission***

In 1989-1999 IAEA performed on request of the Czech government a number of missions at NPP Dukovany in order to evaluate the general level of nuclear safety at its units (OSART, ASSET), as well as to address specific technical and analytical issues associated with nuclear safety (evaluation of safety findings at VVER-440/213, IPERS).

The OSART mission took place in September 1989 and was followed by a re-assessment Re-OSART mission in November 1991. The purpose of the missions was to complement assessment of the nuclear power plant with the evaluation of maintenance control and implementation and subsequently check on the implementation of potential corrective measures. The conclusions from both the missions at NPP Dukovany were favorable and additional proposals were appended to the final report for further improvement of nuclear safety provision and gradually implemented [1-1],[1-2].

The ASSET mission took place in October 1993 in order to verify the event prevention system, i.e. the so-called "operational events feedback". The 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 the missions ranked very favorably the standard of nuclear safety provision at the plant [1-3],[1-4].

A mission evaluating safety findings was organized in 1996 in order to assess specific design solutions of the NPP Dukovany 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 NPP Dukovany to the implementation of safety recommendations. Another IAEA mission evaluating safety data of NPP Dukovany has been scheduled for 2003 [1-5],[1-6].

The IPERS mission took place in 1998, focusing on PSA first level study, in order to evaluate the analysis and propose specific recommendations to improve it. The final report contained 57 recommendations, gradually addressed in 1999 and 2000 within the Living PSA. At the end of 2000 the status of IPERS recommendations was as follows: 42 recommendations were considered to be resolved, 3 recommendations were not accepted, measures addressing 2 recommendations were suspended, 8 recommendations were scheduled to be addressed in 2001 and 2 recommendations were scheduled to be included into analyses of external events in the coming years.

***Supporting analyses performed within international projects of technical cooperation***

After 1990 NPP Dukovany took the advantage of offered international technical cooperation projects organized by IAEA, European Union, OECD-NEA or individual countries based on bilateral agreements. A number of safety analyses was performed within these projects, e.g. evaluation of piping systems integrity, PSA levels 1 and 2, analyses of operational inspections efficiency, analyses supporting I&C system replacement, studies dealing with optimization of operational and technical documents etc.

***Exchange of operational experience within WANO***

NPP Dukovany has been a member of the World Association of Nuclear Installations (WANO) since 1990, within the Moscow center. The plant uses the organization's international electronic communication network - "Nuclear Network" to acquire experience which effectively helps to improve its nuclear safety. In connection with the membership a "Peer Review" WANO mission took place at NPP Dukovany in 1997, which concluded that the plant was operated at a high standard.

***Joint activities of VVER-440/213 operators***

Since 1990 NPP Dukovany has been involved in the joint effort of VVER-440/213 operators within the framework of so-called "VVER-440/213 Club" with the common objective - to support the safety enhancement process. Members of the Club prepared the so-called "Minimal list of actions for the enhancement of nuclear safety" which is being implemented at the individual plants and members of the Club inform each other on the progress and concerns of the implementation.

***Technical audits (internal, external)***

A technical audit was held at NPP Dukovany in 1993-1995 in two stages:

- internal technical audit, whose purpose was to map the current status of the NPP systems and individual equipment. The equipment condition was evaluated using two approaches – first level PSA and using a deterministic approach with the employment of operational safety report, studies and analyses. The internal audit was performed by the plant's own specialists and the resulting output was an overall evaluation of the individual units, including proposals of modernization efforts relating to nuclear safety, reliability and economical operation [1-8].

- external technical audit, whose purpose was an independent evaluation of nuclear safety provision at the individual units of the plant, in agreement with current 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- using the methodology for periodic safety review of nuclear power plants issued as IAEA Safety Series (SG-012) in cooperation with SÚJB. The final report contains a set of recommendations focusing particularly on enhancement of the defence "in-depth", and methodical procedures [1-10].

The results of technical audits have been used as inputs for the anticipated modernization of NPP Dukovany.

***Probabilistic Safety Assessment (PSA level 1)***

The first PSA level 1 from NPP Dukovany was completed in 1993 in cooperation with Czech and Slovak research institutes (ÚJV, a.s., Řež, VÚJE etc.) and the SAIC company (USA); by evaluating gradually performed technical changes on the reactor units and by improving the PSA procedure itself their results are getting more and more accurate. The main conclusion of the PSA level 1 study [1-7] completed in 1993 was that it was possible to further reduce probability of core melting for NPP Dukovany reactor units. Based on this conclusion a process was started to identify and remove dominant causes that might result in potential degradation of the reactor core. The process has become an integral part of the planned modernization and priority setting for individual steps of the NPP Dukovany modernization.

PSA level 1 study has been updated on regular basis since 1995, within the Living PSA and the current version includes internal initiation events, fires and floods. The Living PSA represents efforts to maintain PSA in a form reflecting the current status of the plant and also extends the PSA study to cover additional events. NPP Dukovany ranks among those nuclear power plants using in full scope the Living PSA for day-to-day decisions making during repairs, maintenance and operation of the units.

Moreover, the so-called Shutdown PSA (SPSA) was completed in 1999 – i.e. PSA for low-output conditions of the reactor and for reactor shutdown. The results of SPSA have shown that the contribution to the overall core degradation during outages is comparable with the contribution during operation at full power.

PSA level 2 was completed in 1998 – in the scope similar to that used for US nuclear power plants. Once completed the analysis was also updated within the Living PSA. The conclusions have been used as inputs into a procedure dealing with serious accidents.

In 2000 the probability of reactor core degradation for NPP Dukovany achieved $1{,}74.10^{-5}$/year, a level on par with the best nuclear units.

More information on the probabilistic evaluation of NPP Dukovany units is provided in chapter 9.1.2.

***Safety evaluation of NPP Dukovany units after 10 years of operation***

In order to obtain a license to continue the operation of NPP Dukovany units following ten years of their operation the national regulatory body (ČSKAE) required submission of a safety report in 1991. The report was supposed to demonstrate the status of nuclear safety provisions at the individual units, using the latest scientific knowledge and technology in compliance with valid legal regulations, IAEA recommendations and results of international missions.

The safety evaluation by SÚJB of individual units following the 10 years of their operation, conducted in agreement with IAEA recommendations (SG-012, Periodic safety review), resulted in additional requirements for specific measures to increase the standard of nuclear safety provision. Apart from the required analyses, the resolutions by SÚJB about continuing operation of individual units also demanded more documents demonstrating safety, draft program of works to improve safety and reliability, as well as requirements for implementation of such measures within the specified deadlines. These SÚJB requirements were incorporated into short-term measures, as well as into the anticipated modernization program. For more details refer to chapter 9.1.2 hereof.

***Assessment by insurance pools***

Since 1995 when the Czech Republic joined the IAEA convention on liability, NPP Dukovany has been intensely seeking to obtain property and liability insurance. The efforts to conclude insurance contracts peaked in 1996 when the first inspection by insurance pools was held in the countries of Central and Eastern Europe. The resulting final report concluded that NPP Dukovany was insurable under the worldwide insurance standards. The legislative issues of liability for nuclear damages are specified in Act No. 18/1997 Coll.(Atomic Act) in § 32 ÷ 38. In 1997 an insurance agreement was signed to cover liability from risks associated with operation of NPP Dukovany. In 1998 a contract was signed to cover risks to the property. In November 2000 a repeated inspection by the insurance pools was performed at NPP Dukovany, as a follow-up to the inspection held in 1996. The purpose of the inspection was to evaluate the progress and developments at the plant over the four years. The final assessment was favorable and the premium payment has been reduced.

***Assessment by WENRA***

In 2000 the association of West European nuclear regulators (WENRA) performed an assessment of nuclear safety in the candidate countries for EU membership. The assessment of NPP Dukovany resulted in the following conclusions: the safety culture is sufficient, safety evaluation and document verification, i.e. periodic safety reviews are performed using procedures comparable with Western practices. Once the modernization program is fully completed it is expected that NPP Dukovany will achieve a safety level comparable with that at nuclear power plants of the same operational age in Western Europe.

***Periodic safety review***

Another periodic reviewt has been scheduled for 2005-2006 (the so-called PSR) after 20 years of operation. In agreement with the IAEA and EU instructions and recommendations, the main part of PSR will be performed by NPP Dukovany specialists. A detailed structure of the assessment, its schedule and assessment criteria will be based on the current requirements of the Czech legislation and IAEA and EU instructions. The PSR after twenty years of operation will be, in respect to its goal and scope, analogical to the internal and external audits carried out after ten years of operation, and it will include assessment of all implemented technical changes, results of newly performed analyses in the safety-related documents, experience from operation, operational and safety indicators during the evaluated decade and safety forecast for the coming ten years. The PSR results will be taken into account in the development of a modernization plan for NPP Dukovany.

### 1.1.2.2 Implemented and planned measures to increase the standard of nuclear safety

***Situation following the Chernobyl accident***

On 20 November 1986 the government of ČSSR adopted the resolution No. 309 requiring implementation of the so-called ”Back-fitting of Nuclear Power Plant Dukovany”, whose main purpose was the improvement of its nuclear safety. The resolution represented a response to the first findings from the Chernobyl accident. This resolution was adopted similarly as in many other countries, despite the fact the Chernobyl reactor had had entirely different physical and technical parameters than the pressurized water reactors employed in Dukovany. The initial design of the "Back-fitting" was completed in 1990, its implementation started in 1991 and was completed in 1996. Most of the anticipated measures were implemented. Moreover, a number of additional measures was introduced in equipment modernization outside the ”Back-fitting” project.

A comprehensive assessment of the actual condition of NPP Dukovany was performed in 1992 - 1997 (see chapter 1.1.2.1). Results of the assessment have been translated into the so-called MORAVA program of equipment modernization. The modernization part of the program addresses safety recommendations made by IAEA.

A list of changes and improvements implemented within the "Back-fitting" project and modernization program is provided in Appendix No. 1 hereto.

***MORAVA Modernization Program for NPP Dukovany***

In connection with the activities described in the chapter 1.1.2.1 hereof the so-called MORAVA modernization program has been elaborated for NPP Dukovany. A general content of the modernization was established in 1997-1998. Essentially, the program represents a prioritized list of partial projects, their schedule for preparatory works and implementation and assessment of their feasibility. The implementation of the modernization program has already started. The purpose of the modernization program is to achieve compliance with the worldwide safety practices.

The most important project currently under way has been the replacement of the I&C system on safety-important parts with digitals systems. The replacement will be performed gradually during units outages for refueling and its completion has been scheduled for 2010. A tender was conducted for preparation and implementation of the project and a contract was signed in September 2000 with a consortium of FRAMATOME and Schneider Electric. Currently, preparation of design documents has been under way. The entire modernization program will be implemented by 2010.

The modernization program also covers safety findings made by IAEA. The follow-up status of each safety finding can be found in Appendix 2. From the overall number of 74 safety findings in respect to VVER 440/213 design 39 have been already resolved. For more details about the MORAVA program refer to Appendix No. 5 hereto.

Figure 1-1 Map of the Czech Republic indicating the nuclear power plants on its territory

### 1.1.3 Nuclear power plant Temelín

#### 1.1.3.1 Overview of nuclear safety assessments performed and their main conclusions

***History of the project and its assessments***

The decision to construct a nuclear power plant at Temelín site was made in 1980 as a result of expert site selection procedure for 4 nuclear units with VVER-1000 reactors. The contract for a supply of the so-called "Technical design" from the former USSR was signed in 1982. The design included the reactor building, auxiliary building and diesel generator stations. The design of the plant's secondary part the responsibility of the Czech party to the contract. The Basic Design of Temelín units 1 and 2 was completed by the general designer company Energoprojekt (EGP) Praha in 1985. The planning and siting decision was issued in 1985 and the construction permit was provided in November 1986. Construction of the buildings was launched in February 1987 while preparatory works at the site had started in 1983.

Czech and Slovak specialists analyzed and subsequently modified the original design as early as before 1989.

After 1989, in the new political and especially economical conditions, the demand of the Czech Republic for power of 4000 MW was re-evaluated and at the same time new analyses of the design nuclear safety were performed, taking into account experience from Western nuclear power plants. The government of the Czech Republic approved completion of the plant's two units in March 1993. The fuel loading into Unit 1 took place in July 2000 and the fuel loading into Unit 2 has been planned to take place approximately 15 months later.

***Appraisals by international experts***

Several international missions have been performed at the Temelín since the early 1990s. These missions were invited for the purpose of independent appraisal of the original design and some other aspects of the plant construction from the viewpoint of internationally recognized standards.

In 1990, upon invitation from the then Czechoslovak government, the IAEA organized the following three international missions of experts :

- mission aimed at evaluation of the site safety (April 1990),
- Pre-OSART mission, dealing with construction practices and preparation of safe operation (turn of April/ May 1990),
- mission focused at the safety systems evaluation, core design and safety analyses (turn of June/July 1990).

The missions concluded that the design of NPP Temelín, its siting and organization of construction did not show any significant deviations from the international practices. Final reports from the missions [1-12] [1-13] [1-14] included partial recommendations supposed to contribute to safety enhancement. The recommendations were implemented both in form of changes of and amendments to the design and within the organization of the construction and preparation for future operation.

A follow-up Pre-OSSART mission took place in February 1992 to assess to what degree the 1990 recommendations [1-15] were considered and implemented in the construction and preparation for future operation.

Other significant activities by IAEA in respect to NPP Temelín included particularly the following:

- QARAT mission focusing on quality assurance ( turn of March/April 1994) [1-16],
- consultants meeting on the Temelín design changes at the IAEA Headquarters in Vienna (turn of November/December 1994) [1-17],
- mission focusing on fire protection (February 1996) [1-18].

A special IAEA mission in 1996 examined how NPP Temelín plant addressed the safety issues identified by the IAEA as generic for nuclear power plants with VVER-1000/320 type reactors [1-19]. The mission evaluated the plant's upgraded design, implementation of previously suggested alterations and its preparedness for operation. This included the compatibility issues, i.e. compatibility of modern Western technology with the original Russian design. In general, the mission concluded and highly commended that the future operator had spent a significant effort to improve the plant's design [1-20]. The mission emphasized that the combination of Western and Eastern technology in the Temelín design was very carefully considered. In the mission's opinion, in some cases such a combination of Western and Eastern technologies resulted in a pronounced improvement of the safety assurance level in comparison with international practices.

A follow-up mission of the same type has been scheduled for November 2001. The status of each VVER 1000/320 safety issue as specified by IAEA can bee found in Appendix No. 2 hereto.

In addition to the above mentioned there was a number of other expert IAEA missions at NPP Temelín, e.g. two IPERS missions on the PSA study, three missions on LBB analyses and s an IPPAS mission on physical protection in 1998.

In the early 2000 there was another Pre-OSART mission and in February 2001 the full-scope OSART mission was held at NPP Temelín. An overview of the main conclusions from these missions is provided in Appendix No. 3 hereto.

***Assessments from the bilateral cooperation with Germany***

Within the framework of activities based on a valid bilateral agreement between BMU and SÚJB on the exchange of information on nuclear safety and radiation protection, discussions were held about safety of NPP Temelín and NPP Isar. The parties have agreed on seven selected nuclear safety issues at NPP Temelín to be considered in detail by GRS. The assessment was completed in the fall 2000 concluding that no nuclear safety-related reasons have been found preventing commissioning of NPP Temelín.

Further, it has been concluded that from the viewpoint of German standards the design mostly complies and in the remaining cases the design mostly meets standards of other Western countries, particularly those of the US.

Finally, GRS has kept open two issues where it was unable to assess from the available sources, whether the design solution of the steamline and feedwater pipings is sufficient to prevent subsequent damage. GRS also expressed the need to document that qualification requirements for safety valves on steam-generators and condenser dump valves for water-steam mixture have been met for the specific conditions at NPP Temelín.

***Assessments by WENRA***

There are also results available from two assessments by the association of regulatory bodies from Western countries – WENRA – performed in 1998 and 2000. Main conclusions from the WENRA report issued in October 2000 are the following:

- The program for NPP Temelín safety improvement 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;
- A combination of Eastern and Western technologies has been successfully mastered. Interfaces between different technologies have been considered within the modernization program and a standard Western approach has been used for combining of Eastern and Western technologies. It will be necessary to confirm correctness of the combination during the plant's commissioning;
- Only two safety issues have been mentioned as requiring more clarification and if resolved, NPP Temelín will achieve a safety standard comparable with the safety standard of PWR units operated in the West.

The process of combining Eastern and Western technologies was evaluated by ENCONET Consulting (Austria). The conclusion has been similarly favorable as that by WENRA in 2000.

***Analyses contracted by the future operator***

In addition to the activities listed above, ČEZ, a.s. contracted the American Consulting company Halliburton NUS in 1991 to perform an audit focused at technical concept of the power plant and to verify whether the plant would be licensable with respect to standards accepted in developed countries. The audit concluded that the license might be obtained in case all the specified recommendations were fulfilled as well as the requirements of the Regulatory Bodies [1-21].

Moreover, some analyses were performed by COLENCO (Switzerland) [1-22] and TŰV Bayern e. V. (Germany) [1-23], which closely focused on I&C design assessment

***Probabilistic Safety Assessment (PSA levels 1 and 2)***

Based on recommendations from the IPERS missions and the plant's self-assessment it was decided to start a PSA project. The main purpose of the project was the systematic assessment of NPP Temelín (Unit 1) and accident risks using the PSA study levels 1 and 2. Works on the first basic version of PSA started in 1993 and were completed in 1995. The works were performed by a team of experts from Halliburton NUS, NPP Temelín and more specialists from EQE, ÚJV Řež and EGP Praha, managed by NUS.

A specific version of the "Safety Monitor" software was developed by Scientech for NPP Temelín as one of the planned PSA applications – "Safety Monitor NPP Temelín" and the existing PSA models for all operational conditions and levels 1 and 2 were converted and applied. The mentioned software along with converted PSA models have enabled to analyze in real-time the impact of both actual and planned configurations of the plant, including maintenance and testing conditions of equipment at specific risk levels, while no detailed knowledge of the PSA methodology is required.

Since the completion of the PSA project at NPP Temelín a gradual reviewing of the models has been performed and specification of problems to be addressed in the updating of models for PSA NPP Temelín. A special database has been established for the purpose, containing, among other things, also comments resulting from IAEA missions. The updating of PSA started in January 2001.

More information on the PSA NPP Temelín can be found in the chapter 9.1.2.

***Assessment by insurance pools***

NPP Temelín made preparations for property and operational insurance already during the construction period. The activities were conducted along with the development of documents and peaked in the inspection by nuclear insurance pools in May 2000.

In June 2000 an insurance contract was signed covering liability from operation-related risks at NPP Temelín and an insurance contract for property damage at NPP Temelín. The contracts were preceded by a pre-operational inspection by nuclear insurance pools held in May 2000. Its purpose was to assess the plant's condition as the initial basis for the insurance. Unit 1 was insured first. The insurance came into effect with the Unit 1 fuel loading. At present also Unit 2 has been insured and the insurance will similarly come into effect after its first fuel loading (the insurance comes into effect on the day the first fuel assembly to be loaded into Unit 2 of NPP Temelín leaves the fresh fuel storage in the NPP Temelín complex).

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

Results of the independent international expertise organized by the IAEA, proposals of Czech specialists (including the SÚJB recommendations) and results of the NUS Haliburton audit were used as a basis for technical improvements which, once implemented, will assure that NPP Temelín Units 1 and 2 reach engineering standards usual for Western power plants in the late 1990s.

Recommendations for the design improvement were handed over to the general designer, EGP Praha, to be implemented in form of amendments to the Basic and Detail design, in co-operation with other specialized companies and major suppliers of technology.

Among a number of improvements related to the replacement of components and systems, the following should be mentioned:

- 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 of the design
    - electric protections
    - addition of $4^{th}$ and $5^{th}$ diesel generators
    - increased capacity of accumulators, etc.

A detailed list of significant changes and improvements is provided a table in Appendix 1 hereto.

To complement the preliminary safety documents [1-24] all safety analyses were repeated while taking into account all technical improvements and replacements. These analyses were performed using advanced Western computer codes and to the depth and in the structure required by Western standards (US NRC Regulatory Guide

1.70). Results of the probabilistic safety assessment studies level - 1 and 2 will complement the above-mentioned deterministic analyses to assess the final configuration of the Temelín project.

### 1.1.3.3 Process and present status of NPP Temelín commissioning

***Process and present status of Unit 1 commissioning***

***Important tests before the non-active stage of commissioning***

Containment integrity test

The test was performed during December 1998 and January 1999 and confirmed a high quality of the civil construction and installation works. The achieved leaktightness rate was lower then established in the design and safety documentation.
Established leaktightness rate - 0,1 % containment volume/per day
Established test leaktightness rate - 0,4 % containment volume/per day
Achieved leaktightness rate - 0,04 % containment volume/per day

Pressure tests and leaktightness tests of the primary and secondary circuits

The Pressure tests were successfully performed in October 1999. The primary circuit was tested at 24,5 MPa (the normal operation pressure is 15,7MPa) and the secondary circuit was tested at 10,8MPa (the normal operation pressure is 6,3 MPa). Leaktightness tests followed at 19,6 MPa for the primary circuit and at 8,7MPa for the secondary circuit.

***Non-active stage of commissioning.***

In agreement with the Atomic Act and Decree No. 106/98 SÚJB issued a resolution on 25 February 2000, approving the non-active stage of commissioning. The resolution was based on favorable results of the following:

- reviewing of all prescribed documentation for this stage,
- results of an inspection of
  - prescribed tests
  - preparedness of all systems and personnel for the tests

The goal of the stage was to test all systems and their co-operation (hot functional tests) under normal operating conditions ( temperature in the primary circuit 280 °C and pressure 15,7 MPa.)

Course of the non-active testing

March 1 - 6 April - the normal operating temperature and pressure were achieved, hot hydraulic tests of the primary and secondary circuits, leaktightness tests on the primary and secondary circuit

7 April – 30 June – inspection of the Unit 1 equipment

***Physical Start-up***

In agreement with the Atomic Act and Decree No.106/98 SÚJB issued a resolution on 5 July 2000, approving the active stage of commissioning – the physical start-up (fuel loading). The resolution was based on favorable results of the following:

- reviewing of prescribed documentation for this stage,
- results of an inspection of
  - non-active stage and meeting of all established criteria in compliance with the established programs
  - preparedness of all systems and personnel for the active stage of commissioning
- approved program for the stage and selected programs for physical start-up
- approved operational Limits and Conditions
- meeting of all requirements previously established by SÚJB

***Course of the active stage of physical start-up***

The first fuel loading started on 6 July 2000
15 July: completion of the fuel loading inspected by SÚJB and IAEA inspectors and core sealing
25 – 26 July: completion of the leaktightness test on the primary and secondary circuits

29 July – 3 August: successfully passed verification test of the containment integrity (the achieved leaktightness rate was 0,068% of the containment volume/day )
17 August: completion of tests on ESFAS and DESF systems
10 September: mode 4 and completion of tests prescribed for mode 5
14 September: mode 3 and completion of all tests for mode 4

Beginning of physical tests - a license issued by SÚJB to achieve first criticality

Based on the submitted results of the previous stage and the first stage of the physical start-up SÚJB issued on 9 October 2000 a license for the second stage of the physical start-up (first criticality and physical tests)

11 October 2000 at 6:19: the first criticality was achieved at 1.2 x $10^{-2}$ % of the nominal power

11-25 October: tests of neutron and physical parameters, neutron-flux measurements, efficiency of main control rods, xenon poisoning, output reactivity coefficient etc.

26 October: shutdown of all MCPs and manual reactor trip (HO1 )

***Power start-up***

In agreement with the Atomic Act and Decree No.106/98 SÚJB issued a resolution on 31 October 2000, to approve the active stage of commissioning – power start-up ( at 5% of nominal power output). The resolution was based on the following:

- reviewing of prescribed documentation for this stage,
- results of an inspection of the active stage – physical start-up and meeting of all established criteria in compliance with the established programs
- approved program for the stage and selected programs for the power start-up
- meeting of all requirements previously established by SÚJB

The main precondition of this resolution is that the applicant shall submit results of tests performed on each power output level before shifting to a higher output level. SÚJB is required to issue a license based on favorable assessment of the submitted results.

- power start-up –power output levels: 5% $N_{nom}$ ; 12% $N_{nom;}$ 30% $N_{nom;}$ 45% $N_{nom}$; 55% $N_{nom}$; 75% $N_{nom}$; 90% $N_{nom}$; 100 $N_{nom}$;

Power level 5% $N_{nom}$

31 October - 12 November: – test of a condenser dump station and respective controls, calibration of neutron-flux measurements, tests of secondary circuit systems, tests of the reactor limitation system, tests of secondary side controls and cooperation of unit controls, tests of feedwater pumps driven by the turbine, tests of cooperation of unit controls).

Power level 12% $N_{nom}$

The licensee submitted in accordance with conditions of the SÚJB resolution October 31, 2000 the prescribed documentation and evaluation of 5% power level results. After reviewing the submitted documents and results of SÚJB inspections SÚJB permitted initiation of tests at 12% $N_{nom}$ on November 14, 2000.
16 November – 9 December: test of steam transmission from the steam dump station to atmosphere on the turbine by-pass, test of cooling with natural circulation – due to the poor set-up of PRPS a reactor trip occurred following shutdown of all MCP, tests of the secondary side systems, including feedwater pumps driven by the turbine and TG
22 November: problems with turbine vibrations - turbine low pressure part 3 (TG)
24 November – shut-down of the unit due to problems on the secondary side - TG
25 November – 3 December: low-pressure part of TG disassembled, repair of the labyrinth seal, Unit 1 shutdown
5 December: test of natural circulation cooling successfully repeated

Power level 30% $N_{nom}$

The licensee submitted in accordance with conditions of SÚJB resolution of October 31, 2000 the prescribed documentation and evaluation of 12% power level results. After reviewing the submitted documents and results of SÚJB inspections SÚJB permitted initiation of tests at 30% $N_{nom}$ on December 15, 2000.
16 December: condensate pumps trip followed with a reactor scram and ESFAS actuation (stream line break signal) from low pressure in the secondary circuit

21 December: TG connected to the grid for the first time
26 December 2000 – 4 January 2001: TG unstable operation, TG shutdown for steam and oil leaks repair
7 January: reactor scram from low level in the pressurizer
17 January: test of external power supply failure
17 January – 17 February: cold shutdown for the purposes of inspecting and maintenance of systems and equipment
23 February: SÚJB issued a permission to continue operation at 30 % $N_{nom}$, second revision of the power start-up program was approved (the power level 45 % $N_{nom}$ was cancelled and its tests moved to other levels)
8 March: completion of tests at power level 30 % $N_{nom}$.

Power level 55% $N_{nom}$
The licensee submitted in accordance with conditions of SÚJB resolution of October 31, 2000 the prescribed documentation and evaluation of 30% power level results. After reviewing the submitted documents and results of SÚJB inspections SÚJB permitted initiation of tests at 55% $N_{nom}$ on March 19, 2001.
27 March: reactor power output 55 % $N_{nom}$ (430 MW) reached
2 April – 17 April: reactor power decreased below 2 % $N_{nom}$, repairs and adjustments performed on TG
20 April – 470 MW
26 April: After several attempts to reduce the vibrations the operator again decided to decrease the power output level, to dismantle the turbine and to inspect all rotor and stator parts. Seeing that some defects require a repair of turbine rotors by the manufacturer the operator executed cold shutdown of the reactor on May 6. Modifications of the steam control valves and steam turbine lubrication system were performed during the outage.

30 May: During the scheduled test of safety system components the start-up of two low-pressure pumps occurred. As a result the making-up water started overflowing over the edge of the opened reactor vessel and 80$m^3$ of low-active coolant (with activity of 20kBq/l) spilled into the outer protective area. The event was classified as INES 1 on the 8-level international scale of events.

***Process and present status of Unit 2 commissioning***

***Important tests before the non-active stage of commissioning***

Containment integrity test

The test was performed during December 2000 and confirmed a high quality of the civil construction and assembling work. The achieved leaktightness rate was lower then established in the design and safety documentation.
Established leaktightness rate - 0,1 % containment volume/per day
Established test leaktightness rate - 0,4 % containment volume/per day
Achieved leaktightness rate - 0,07 % containment volume/per day

***Strength pressure tests and leaktightness tests of primary and secondary circuits***

The first low pressure tests of primary and secondary circuits were successfully performed in July 2001.

## 1.2 Statement on implementation of the obligations under Article 6 of the Convention – position of the Czech Republic on the current status of nuclear safety and future operation of the nuclear installations

All the above-mentioned studies and analyses unequivocally prove that the level of nuclear safety provision at NPP Dukovany units is high and in compliance not only with current requirements valid in the Czech Republic but also with internationally accepted practices. Moreover, the nuclear safety status has been systematically reviewed and evaluated from the viewpoint of the latest scientific and technical knowledge. Necessary upgrading activities are planned and implemented so that the current status is maintained or further improved in the future. The Czech Republic as a signatory of the Convention considers all the requirements under Article 6 of the Convention fulfilled for NPP Dukovany and there are no plans to reduce its operation, neither in short nor medium-term prospect.

By the time of development of this National Report the design changes for NPP Temelín had been completed and were in the process of implementation. Analyses performed until now by international agencies, as well as by SÚJB, have demonstrated that NPP Temelín will after its completion under the modified design conform to both the current requirements valid in the Czech Republic and internationally recognized standards.

The safety of NPP Dukovany and NPP Temelín has been assessed as part of the accession process to the European Union, by a group dealing with the atomic issues (AQG) and a working group for nuclear safety (WPNS). Their recommendations (general and specific for the Czech Republic), including a response provided by the Czech Republic, are shown in Appendix 4 hereto.

# 2. Legislative and Regulatory Framework - Article 7 of the Convention

*1. Each contracting party shall establish and maintain a legislative and regulatory framework in order to provide for safety of nuclear installations*

*2. The legislative and regulatory framework shall include:*

*(i) establishing of applicable national safety requirements and regulations;*

*(ii) a system of licensing with regard to nuclear installations and a prohibition to operate a nuclear installation without the respective license;*

*(iii) a system of inspections and assessments of nuclear installations by the national regulatory body to ascertain compliance with applicable regulations and terms of the licenses;*

*(iv) application and enforcement of the applicable regulations and terms of the licenses, including license suspension, modification or withdrawal.*

## 2.1 Description of the current situation

### 2.1.1 Development of national legislative and regulatory framework

The legislative and regulatory framework for the nuclear energy industry in the Czech Republic has had a relatively long history. Its beginnings date back to second half of 1970s are connected with the construction and operation of first nuclear power plants with VVER reactors in former Czechoslovakia.

A legislative process regulating industrial utilization of nuclear energy was launched by the amendment to **Act No. 50/1976 Coll.**, on land planning and building regulation (the Building Act) and its implementing regulations – **Decree No. 83/1976 Coll.**, on construction documentation and **No. 85/1976** Coll., on more detailed zoning and planning decision procedure and building regulations. The Building Act from 1976 established for the first time the obligation to have a special approval from the Regulatory Body (ČSKAE at that time) for construction of a nuclear installation. Decree No. 85/1976 Coll. defined the types and content of safety reports required by the ČSKAE to permit construction of nuclear installations:

- siting (initial) safety report - for the purposes of the siting decision,
- preliminary safety report - for the purposes of the construction permit,
- pre-operational safety report – a approve commissioning of the installation.

Decree No. 83/1976 Coll. established that the three types of safety reports shall be an integral part of the documentation for constructions with nuclear installations.

In 1978 – 1980 ČSKAE issued the following binding regulations related to the above mentioned decrees:

***Edict No. 2/1978 Coll. by ČSKAE,*** on nuclear safety assurance in the process of designing, licensing and implementation of constructions with nuclear power installations, establishing technical requirements and safety criteria for nuclear power plants designs.

***Edict No. 4/1979 Coll. by ČSKAE,*** on general criteria for nuclear safety assurance in the process of siting of constructions with nuclear power installations, establishing necessary requirements and exclusion criteria for nuclear power plants siting,

***Edict No. 5/1979 Coll. of the ČSKAE,*** on quality assurance for selected items in the nuclear power industry in respect to nuclear safety, introducing a quality assurance system into the activities and components important from the viewpoint of nuclear safety.

***Edict No. 6/1980 Coll. by ČSKAE,*** on nuclear safety assurance in the process of commissioning and operation of nuclear power installations, defining individual stages of the commissioning process and specifying documentation and requirements necessary for the issuance of a license for the next stages.

**Act No. 28/1984 Coll**. on state supervision of nuclear safety at nuclear installations was the last in this first phase of the legislative framework development in the Czechoslovak Republic. This Act established the body to carry out the state supervision of nuclear safety, independent on manufacturers and operators of nuclear installations - the former ČSKAE. Act No. 28/1984 Coll. also introduced some important basic definitions:

***nuclear safety -*** the condition and ability of a nuclear installation and its personnel to prevent uncontrolled development of a fission chain reaction and inadmissible release of radioactive substances or ionizing radiation to the environment,

***nuclear installation -*** a construction and operating unit containing a nuclear reactor or a facility for storage,

processing, disposal and transport of radioactive wastes and fresh or spent nuclear fuel,

***responsible organization*** **–** an organization which provides for the construction and operation of a nuclear installation or transport of radioactive wastes and nuclear materials.

Act No. 28/1984 Coll. established for the first time that responsibility for nuclear safety of a nuclear installation shall be born by its owner or operator (responsible organization).

The above-mentioned act and other legislative regulations established basic requirements for nuclear safety and rules to carry out the state supervision, including definition of powers of the regulatory body, e.g. the power to approve Limits and Conditions of safe operation, start-up programs, quality assurance programs, as well as the authority to verify professional competence of selected personnel at nuclear installations. They also defined the enforcement instruments - penalties for violation of the law or endangering of nuclear safety, as well as the authority to order that power output of a nuclear installation is reduced or the installation is shutdown in case of a danger of delay.

At that time the Act No 28/1984 Coll. and the related legislative documents represented important and modern instruments for the nuclear safety control and in the conditions of former Czechoslovakia contributed to its new quality and standard, comparable with the worldwide practices, especially with IAEA recommendations.

This legislative framework was in 1984 - 1990 complemented with a number of other regulations:

***Edict No. 9/1985 Coll. by ČSKAE,*** on nuclear safety assurance for nuclear research installations, establishing technical and organizational requirements for nuclear safety assurance of research reactors,

***Decree No. 67/1987 Coll. by ČSKAE,*** on nuclear safety assurance in radioactive waste management, defining requirements for systems and activities related to the processing and storage of radioactive waste generated by nuclear installations,

***Decree No. 100/1989 Coll. by ČSKAE,*** on physical protection of nuclear installations and nuclear materials, introducing into the legislative framework requirements from the Convention on Physical Protection of Nuclear Installations and Nuclear Materials,

***Decree No. 191/1989 Coll. by ČSKAE,*** establishing methods, terms and conditions for verification of special professional competence of selected personnel at nuclear installations (operators),

***Decree No. 436/1990 Coll. by ČSKAE,*** on quality assurance of selected items in respect to nuclear safety, amending the ČSKAE Edict No. 5/1980 Coll.

### 2.1.2 Currently valid legislation in the area of utilization of nuclear energy and ionizing radiation

A totally new era in the state supervisory activities started with the establishing of the independent Czech Republic, at the turn of 1992/1993. The Act No. 21/1992 Coll. established the State Office for Nuclear Safety which on January 1, 1993 assumed the power of the former ČSKAE to carry out state supervision of nuclear safety.

Development of a new law began practically at the same time, with the objective to comprehensively re-codify utilization of nuclear energy and ionizing radiation and, in particular, to address by then insufficiently regulated issues, e.g. radioactive waste management, liability for nuclear damages, emergency preparedness etc.

The Czech Republic's Parliament passed the new **Act No. 18/1997 Coll.**, on peaceful utilization of nuclear energy and ionizing radiation (the Atomic Act) in January 1997. The 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 powers.

The Atomic Act has defined conditions for peaceful utilization of nuclear energy and ionizing radiation, including the activities requiring SÚJB license. 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 Czech Republic's Ministry of the Industry and Trade to establish a new governmental organization for the purpose - the Administration of Radioactive Waste Repositories. Activities of the Administration shall be funded from the so-called "nuclear account" whose main income is represented by payments from radioactive waste producers.

The Atomic Act has 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.

The Atomic Act represents another very significant divide in the development of the Czech legislation. It has declared invalid and replaced the previous regulations and at the same time authorized SÚJB to issue a set of the following related implementing regulations:

***Decree by the SÚJB No. 142/1997 Coll.,*** on type-approval of packaging assemblies for transport, storage, and disposal of radionuclide sources and nuclear materials, on type-approval of ionizing radiation sources, and on type-approval of protective devices for work involving ionizing radiation sources and other devices for handling of ionizing radiation sources (on type-approval),

***Decree by the SÚJB No. 143/1997 Coll.,*** on transportation and shipment of specified nuclear materials and specified radionuclide sources,

***Decree by the SÚJB No. 144/1997 Coll.,*** on physical protection of nuclear materials and nuclear installations and their classification,

***Decree by the SÚJB No. 145/1997 Coll.,*** on registration and control of nuclear materials and their detailed specification,

***Decree by the SÚJB No. 146/1997 Coll.,*** specifying activities directly affecting nuclear safety and activities particularly important from radiation protection viewpoint, requirements for qualification and personnel training, methods of verification of special professional competence and issuing of authorizations to selected personnel, and the form of documentation to be approved to license training of selected personnel,

***Decree by SÚJB No. 147/1997 Coll.,*** establishing a list of selected items and items of dual use in the nuclear industry,

***Decree by SÚJB No. 184/1997 Coll.,*** on requirements for radiation protection,

***Decree by SÚJB No. 214/1997 Coll.,*** on quality assurance in activities related to the utilization of nuclear energy and radiation practices, and establishing criteria for the classification and categorization of specified installations into safety classes,

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

***Decree by SÚJB No. 219/1997 Coll.,*** on details of emergency preparedness of nuclear installations and workplaces with ionizing radiation sources, and on requirements for the content of the internal emergency plan and emergency rules,

***Decree by SÚJB No. 106/1998 Coll.,*** on nuclear safety assurance and emergency preparedness of nuclear installations during commissioning and operation,

***Decree by SÚJB No. 195/1999 Coll.,*** on the requirements for nuclear installations relating to nuclear safety, radiation protection and emergency preparedness,

***Decree by SÚJB No. 196/1999 Coll.*** on decommissioning of nuclear installations and workplaces with significant or very significant sources of ionizing radiation,

***Decree by SÚJB No. 324/1999 Coll.,*** establishing limits for concentrations and nuclear material quantities not covered by the provisions on liability for nuclear damage.

Another important step in the legislation development process was the passing of the so-called "emergency acts " in 2000. They include Act No. **239/2000 Coll.**, on integrated emergency system and changes in some related acts, Act No. **240/2000 Coll**., on emergency management and changes in some related acts (Emergency Management Act) and Act No. **241/2000 Coll.,** on economic measures in emergency situations and changes in some related acts. The said acts came into effect on 1 January 2001, they deal with one of the areas directly associated with nuclear safety and they are compatible with the EU legislation.

Implementation of the Atomic Act is supported by the following binding regulations:

***Decree by the Interior Ministry No. 25/2000 Coll.,*** establishing details of development of the district emergency plan and off-site emergency plan,

***Government Order No. 224/1997 Coll.,*** on the amount and method of payments by radioactive waste producers to the nuclear account,

***Government Order No. 11/1999 Coll.,*** on emergency planning zone,

***Ministerial non-registered regulation*** (issued by the Ministry of the Industry and Trade under No. 9/1997), defining the statute of Administration of Radioactive Waste Repositories.

In connection with the preparations to join the European Union and in order to enable implementation of the commitments resulting from newly entered international treaties the Czech Republic's government approved the amended draft of the Atomic Act. The amended Act was submitted to the Czech Parliament and was passed after the first reading. The amendments concern particularly the provisions relating to radiation protection, to assure compatibility with the applicable European Directives.

A complete list of legal regulations in the field of nuclear energy, ionizing radiation and related regulations is provided in the Appendix No. 6 hereto.

A complete text of the Atomic Act and the related implementation decrees is available at the SÚJB web pages www.sujb.cz.

Through references in the Atomic Act and other regulations the valid Czech legislation in the given area also includes the following international treaties signed by the Czech Republic (or the former Czechoslovak Socialist Republic and later Czech and Slovak Federal Republic):

- The Convention on Early Notification of a Nuclear Accident,
- The Convention on Assistance in the Case of a Nuclear or Radiation Accident,
- The Treaty on Non-proliferation of Nuclear Weapons,
- The Agreement between Government of the Czech Republic and the IAEA on Safeguards, based on the Treaty on Non-proliferation of Nuclear Weapons. Ratification of the Amendment Protocol thereto is going on along with introduction of changes in the legislative framework,
- The Convention on the Physical Protection of Nuclear Materials,
- Vienna Convention on Civil Liability for Nuclear Damage (Third-Party Liability),
- The Joint Protocol relating to the Application of the Vienna and Paris Conventions on Liability for Nuclear Damage.
- Nuclear Safety Convention
- Joint Convention on Safety in Spent Nuclear Fuel Management and in Radioactive Waste Management

In addition to the above mentioned international documents the Czech Republic has also signed the agreement about general ban on nuclear tests which has not come into effect yet.

The Czech republic has also been a pro-active member of the so-called . "IRS" (Incident Reporting System) and the so-called "INES" system (International Nuclear Event Scale) within IAEA.

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

- Agreement between governments of the Czech Republic and the Republic of Austria on regulation of the issues of mutual interest related to nuclear safety and radiation protection,
- Agreement between governments of the Czech Republic and the Federal Republic of Germany on regulation of the issues of mutual interest related to nuclear safety and radiation protection,
- Agreement between governments of the Czech Republic and the Hungarian Republic on regulation of the issues of mutual interest related to nuclear safety and radiation protection,
- Agreement between governments of the Czech Republic and the Slovak Republic on regulation of the issues of mutual interest related to nuclear safety and radiation protection,

A similar agreement is being negotiated with the Republic of Poland.

The legislative framework is concluded with recommendations and guidelines published since 1978 by the State Office for Nuclear Safety in a special non-periodic series of publications: "Safety of Nuclear Installations - Requirements and Guidelines".

***Approval process, inspections and enforcement of compliance with the regulations***

The basic legal standards governing the approval process for nuclear installations include the already mentioned Building Act (No. 50/1976 Coll.) and the Atomic Act (No. 18/1997 Coll.). Act No. 71/1967 Coll., on administrative procedure, Act No. 552/1991 Coll., on state inspection, Act No. 100/2001 Coll., on the assessment

of environmental impacts and Act No. 106/1999 Coll., on unrestricted access to information, represent another important part of the legislative framework in this area, along with the related subordinate legal regulations.

From the viewpoint of the Building Act the local authorities, specifically the competent departments of planning and building control, are supposed to issue four key resolutions for facilities containing nuclear installations , i.e. planning and site decision, construction permit, operation license (for permanent operation) 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 based on an agreement or approval from respective state administration bodies protecting such interests. A respective state administration body shall condition its approval upon fulfillment 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,
- District Office - in respect to fire safety,
  - in respect to waste management,
  - in respect to 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.

§ 126 paragraph 3) of the Building Act expressly establishes that the department of planning and building control, before issuing any resolution on siting, building permit or any additional resolution about a particular project involving a nuclear installation, shall request from the applicant a license (approval) issued by SÚJB under the Atomic Act. Under the law the department of planning and building control shall not issue any resolution unless the said license is submitted.

The Atomic Act establishes activities for which a license issued by the SÚJB is required. Apart from the main activities - siting, construction and operation, there is a number of other activities, e.g. SÚJB licenses 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 3.2.1 hereof.

Act No. 17/1992 Coll., on the environment as enacted later, and especially Act No. 244/1992 Coll., on environmental impact assessment, impose the obligation to assess constructions from the viewpoint of their impact on the environment (to perform ”Environmental Impact Assessment”) within a special proceedings open to the public. The general public may participate either through the respective municipality, which is a party to the proceedings, or through registered civic initiatives. The Ministry of the Environment is the state administration body responsible for the issuance of a resolution concerning the environmental impact of the nuclear power plant.

Inspection activities to be performed by SÚJB defined in detail in § 39 of the Atomic Act, as well as in Act No. 552/1991 Coll. on state inspection , as enacted by Act No. 166/1993 Coll.

Instruments applied to enforce the legislative requirements are regulated by § 40 and 41 of the Atomic Act and include the authority of SÚJB to require the inspected person to remedy the situation, to perform technical checks, inspections or the functional ability tests, to withdraw authorizations about special professional competence 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 facility. Issues of alteration, cancellation and cessation of a license are regulated by § 16 of the Atomic Act, particularly paragraph 4 which authorizes SÚJB to restrict or to suspend performance of the licensed activity if the licensee has failed to fulfill the obligations thereunder.

For more details of the legislation mentioned above and of the licensing procedure see below, particularly chapters 9, 10, 11, 12, 13 and 14 hereof.

## 2.2 Statement on implementation of the obligation concerning Article 7

A system of the described legal documents - laws, decrees, international conventions and intergovernmental agreements, including the series of recommendations and guidelines, has been practically completed and by its nature and contents meets the requirements established in paragraphs 1 and 2 of the Article 7 of the Convention.

# 3. Regulatory Body - Article 8 of the Convention

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

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

## 3.1. Description of the current situation

### 3.1.1 Mandate and competence of the regulatory body

SÚJB (the State Office for Nuclear Safety was established) on 21 December 1992 through the Act No. 21 passed by the Czech National Council. In agreement therewith after the dissolution of the Czech and Slovak Federal Republic, SÚJB assumed the function of former ČSKAE in respect to the state supervision of nuclear safety and nuclear materials. The act confirmed the independent regulatory body within the constitutional framework defining execution of state administration in the Czech Republic. In July 1995 the Czech Republic's Parliament extended the Office competence to include the issues of protection against ionizing radiation. As a result Czech Regulatory bodies in charge of nuclear safety and radiation protection have merged into one and SÚJB has become an integrated state administration body which carries out the state supervision for the whole area of the utilization of nuclear energy and ionizing radiation.

Since 1 July 1997 the competence of SÚJB has been defined by the Atomic Act No. 18/1997 Coll., on peaceful utilization of nuclear energy and ionizing radiation (the Atomic Act), and according to its § 3:

*(1) 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 (hereinafter" the Office").*

*(2) The Office*

a) *shall carry out State supervision of nuclear safety, nuclear items, physical protection, radiation protection and emergency preparedness on the premises of nuclear installations and workplaces with ionizing radiation sources and shall inspect adherence to the fulfillment of the obligations hereunder;*

b) *shall issue licenses to perform activities governed hereunder and shall issue type-approvals for packaging assemblies for transport and storage of nuclear materials and radionuclide sources specified in an implementing regulation, for ionizing radiation sources and for other products;*

c) *shall issue authorizations for activities performed by selected personnel;*

d) *shall approve documentation, programs, lists, limits and conditions, methods of physical protection assurance, emergency rules and, subject to discussion with the relevant District Authority on compatibility with external emergency plans, also internal e emergency plans and their modifications;*

e) *shall establish conditions, requirements, limits, constraints and values for exemption from the effect of this Act;*

f) *shall establish emergency planning zones and shall define area of a workplace with an ionizing radiation source where specific preventive and safety measures for handling of ionizing radiation sources are required (hereafter referred to as the "controlled area");*

g) *in accordance with an implementing regulation, shall establish requirements to ensure emergency preparedness of licensees, and shall inspect their fulfillment;*

h) *shall monitor and assess the exposure status and regulate exposure of people;*

i) *shall provide information to municipalities and District Authorities concerning radioactive waste management within their territory of administration;*

j) *shall co-ordinate activities of the National Radiation Monitoring Network, whose function and organization shall be set out in an implementing regulation, shall provide for the functioning of its head-office, and shall provide for the activities of an Emergency Response Center and for an international exchange of information on the radiation situation;*

k) *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;*

l) *shall maintain a state system of registration and control of nuclear materials and establish*

*requirements for the registration and control of nuclear materials;*

m) *shall maintain a national registration system of licensees, registrants, imported and exported selected items, ionizing radiation sources, and a record exposure of the public and exposure of persons coming into contact with ionizing radiation sources at their work (hereinafter referred to as "exposed workers");*

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

o) *shall approve classification of nuclear installations or their components and nuclear materials into appropriate categories, from the physical protection aspect;*

p) *shall ensure international co-operation within its sphere of competence and, in particular, shall be a intermediary for technical co-operation with the International Atomic Energy Agency;*

q) *shall make decisions ensuring management of nuclear items or radioactive waste if their owner or producer fails to observe proceeds in contradiction with this Act and fails to remedy conditions that have arisen;*

r) *shall be obliged to provide the public with adequate information concerning the results of its activities, unless they are subject to state, professional or commercial secrecy, and once a year to publish a report on its activities and submit it to the Government of the Czech Republic and to the public.*

The competence of SÚJB has been further extended by Act No. 249/2000 Coll. to include state administration and inspecting of the ban on chemical weapons and a similar regulation is being prepared in respect to the ban on biological weapons. As a result, activities of independent inspection have been concentrated in a single central agency which enables to improve their efficiency.

### 3.1.2 Rights and responsibilities of the regulatory body

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

"*(1) A license issued by the Office is required for:*

a) *siting of a nuclear installation or a workplace with very significant ionizing radiation source;*

b) *construction of a nuclear installation or a workplace with very significant ionizing radiation source;*

c) *particular stages, laid down in an implementing regulation, of nuclear installation commissioning;*

d) *operation of a nuclear installation or a workplace with significant or very significant ionizing radiation source;*

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 a workplace with significant or very significant ionizing radiation source;*

g) *decommissioning of a nuclear installation or a workplace with significant or very significant ionizing radiation source; the decommissioning process shall be established in an implementing regulation;*

h) *discharge of radionuclides into the environment;*

i) *ionizing radiation sources management to the extent and in the manner established in an implementing regulation;*

j) *radioactive waste management;*

k) *importation or exportation of nuclear items or transit of nuclear materials and selected items;*

l) *nuclear materials management;*

m) *transport of nuclear materials and radionuclide sources laid down in an implementing regulation;*

n) *professional training of selected personnel of nuclear installations and selected personnel of workplaces with an ionizing radiation source;*

o) *re-importation of radioactive waste originated in the processing of materials exported from the Czech Republic."*

Other provisions of the Atomic Act define:

- conditions to be fulfilled before a license is issued (§ 10),
- probity and professional competence of the applicant for a license (§§ 11 and 12),
- application for a license (§ 13),
- SÚJB administrative procedure (§ 14),

- license particulars (§ 15),
- alterations, cancellations and cessation of license (§ 16).

Execution of the state supervision of peaceful utilization of nuclear energy and ionizing radiation is governed by Section 6 of the Atomic Act which comprises:
- control activities of the SÚJB (§ 39),
- remedial measures (§ 40),
- penalties (§§ 41 and 42).

Thus, the Atomic Act, together with Act No. 552/1991 Coll., on state inspection, enacted by Act No. 166/1993 Coll., provides SÚJB with sufficient instruments to enforce the legislative requirements relating to nuclear safety and radiation protection.

The SÚJB checks whether the bodies who obtained a license in accordance with § 9, paragraph 1 observe the Atomic Act and other relevant regulations.

The SÚJB staff to carry out such checks are inspectors of nuclear safety and radiation protection appointed by the Chairperson of SÚJB. They work at the SÚJB headquarters and directly at the sites of nuclear power plants Dukovany and Temelín, as well as in the Regional Centers (see Chapter 3.1.4 of this National Report). Within their inspection activities, the inspectors and also the Chairperson of SÚJB, are particularly authorized to:

- enter at any time facilities, installations, operation areas, lend and other workplaces of inspected persons where activities related to nuclear energy utilization or radiation practices are carried out,
- check on the compliance with requirements and conditions of nuclear safety, radiation protection, physical protection and emergency preparedness and inspect the nuclear installation conditions, adherence to the Limits and Conditions and operational procedures,
- request evidence of fulfillment of all specified obligations for assurance of nuclear safety, radiation protection, physical protection and emergency preparedness of a nuclear installation and to perform measurements and collect samples at the premises of inspected persons, as necessary for checking on the compliance with this Act and other regulations issues on its basis,
- verify professional competence and special professional competence under this Act,
- participate in investigations and disposal of events important for nuclear safety, radiation protection, physical protection and emergency preparedness, including unauthorized handling of nuclear items or ionizing radiation sources.

Should an inspector identify deficiencies in practices performed by an inspected person, he/she shall be authorized, depending on nature of the identified shortcoming, to:

- require the inspected person to remedy the situation within an established period of time,
- bind the inspected person to perform technical inspections, reviews or tests of functional capability of the installation, its parts, systems or its units, if necessary for verification of nuclear safety,
- withdraw the special professional competence authorization issued to an employee of the inspected person, in the event of serious violation of his/her obligations or his/her failure to meet the requirements of professional competence, and physical or mental capability,
- propose a penalty.

SÚJB shall have the right, if there is a danger of delay or in case an undesirable situations with impact on nuclear safety, radiation protection, physical protection and emergency preparedness, to issue a provisional measure imposing the obligation on the inspected person to reduce the power output or suspend operation of the nuclear installation, suspend assembling of components or systems of a nuclear installation, to prohibit the handling of nuclear items, ionizing radiation sources or radioactive waste, or to impose on the inspected person the obligation to tolerate that the handling is performed by another person, at the expense of the inspected person.

Violation of a legal obligation established in the Atomic Act my be fined by SÚJB with a penalty up to the amount specified in § 41 and in agreement with the rules specified in § 42.

The binding procedures for inspection activities are set forth in SÚJB internal documents.

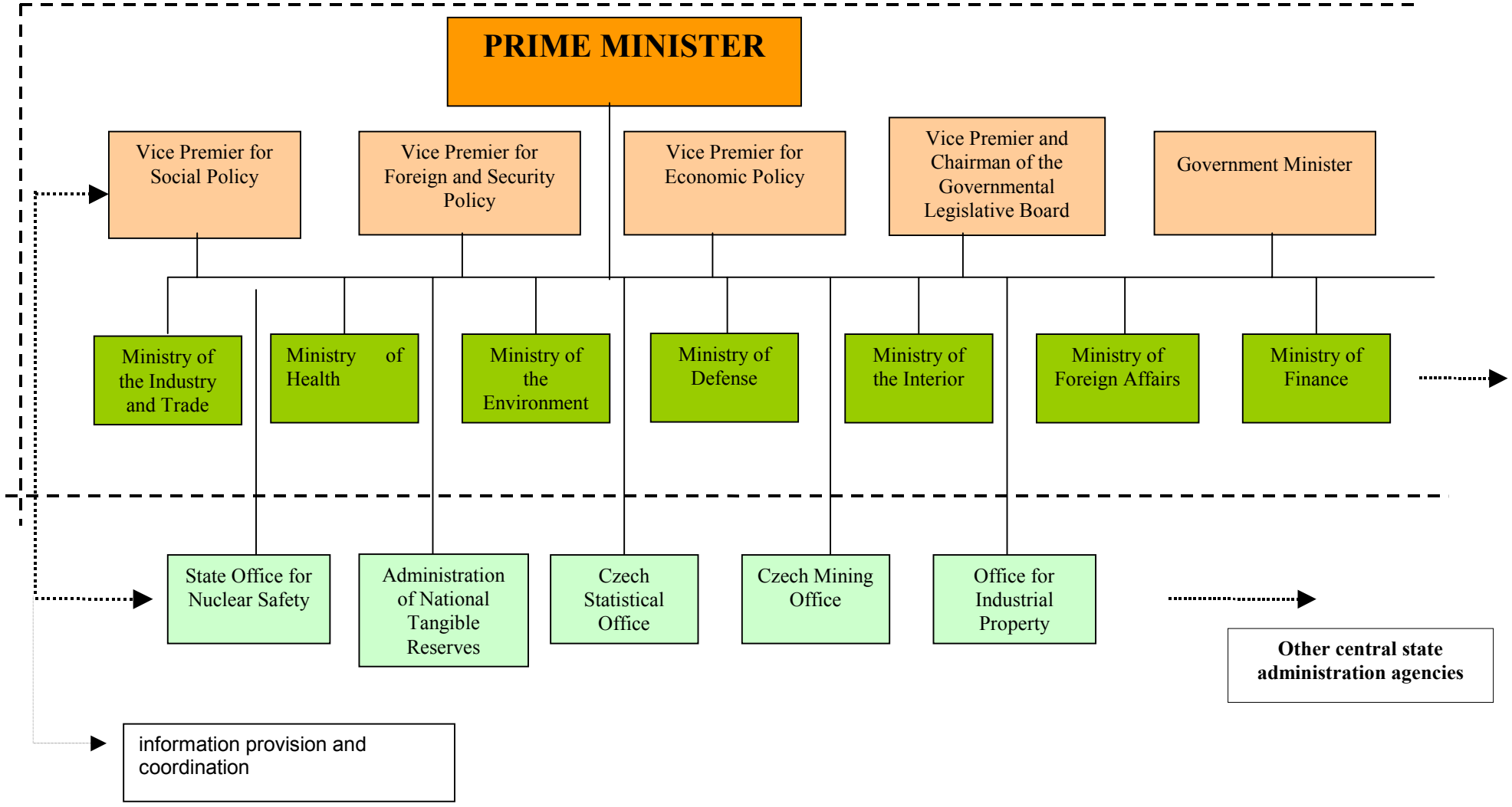
### 3.1.3 Position of the regulatory body within the state administration structure

SÚJB is an independent central state administration body for the area of nuclear safety and radiation protection. SÚJB has its own budget approved by the Parliament of the Czech Republic as a part of the state budget. SÚJB is

headed by the Chairperson appointed by the government. The position of SÚJB within the state administration structure is shown in Fig. 3-1.

Figure 3.1

## Position of the State Office for Nuclear Safety in the State Administration System



### 3.1.4. Structure of the regulatory body, its technical support, material and human resources

For 2000 SÚJB was allotted the staff of 190, approximately 2/3 of that number represent nuclear safety and radiation protection inspectors. The SÚJB budget for 2001 is approximately 278 million Czech crowns (roughly 6.5 million US dollars). In the present Czech Republic conditions, the material and human resources are sufficient for the fulfillment of basic functions to be performed by SÚJB under the law.

The organizational structure of SÚJB is shown in Figure 3-2, and it is consists of:

- Section of Nuclear Safety, which includes department for the assessment of nuclear installations, department of inspections of nuclear installations and department of nuclear materials,
- Section of Radiation Protection, which includes department of radiation exposure regulation, department of sources, department for the environment and radioactive wastes and a separate unit for the radiation protection in nuclear power producing industry,
- Section of Management and Technical Support which includes international cooperation department, economic department, and Office Bureau (dealing with legal issues, personnel training, coordination of scientific efforts and research etc.) and department monitoring the ban on chemical weapons,
- independent unit of emergency preparedness (reporting directly to the SÚJB Chairperson),
- independent unit for quality management (reporting directly to the SÚJB Chairperson),
- independent unit for coordination of activities associated with the accession to the European Union (reporting directly to the SÚJB Chairperson),
- advisory bodies for the SÚJB Chairperson
- Regional SÚJB Centers in Prague, Pilsen, České Budějovice, Ústí nad Labem, Hradec Králové, Brno and Ostrava, which are subordinated to the Radiation Protection Section,
- Local workplaces managed by the Nuclear Safety Section at both nuclear power plants sites (Dukovany and Temelín)

Moreover, SÚJB also acts as a managing authority of the National Radiation Protection Institute (SÚRO), a budgetary organization providing technical support in the area of radiation protection, and State Institute for Nuclear, Chemical and Biological Protection (SÚJCHBO), an allowance organization providing for primary expert and technical supports for SÚJB in chemical and radiation safety.

Responsibilities within the SÚJB organizational structure are established by the Organizational Statute and other internal documents.

Early in 1998 SÚJB the Chairperson established two separate advisory groups made up of independent experts - for nuclear safety and radiation protection. Although activities of these groups are not regulated by law they still represent significant advisory bodies for important issues of nuclear safety and radiation protection addressed by SÚJB.

## ORGANIZATIONAL CHART OF THE STATE OFFICE FOR NUCLEAR

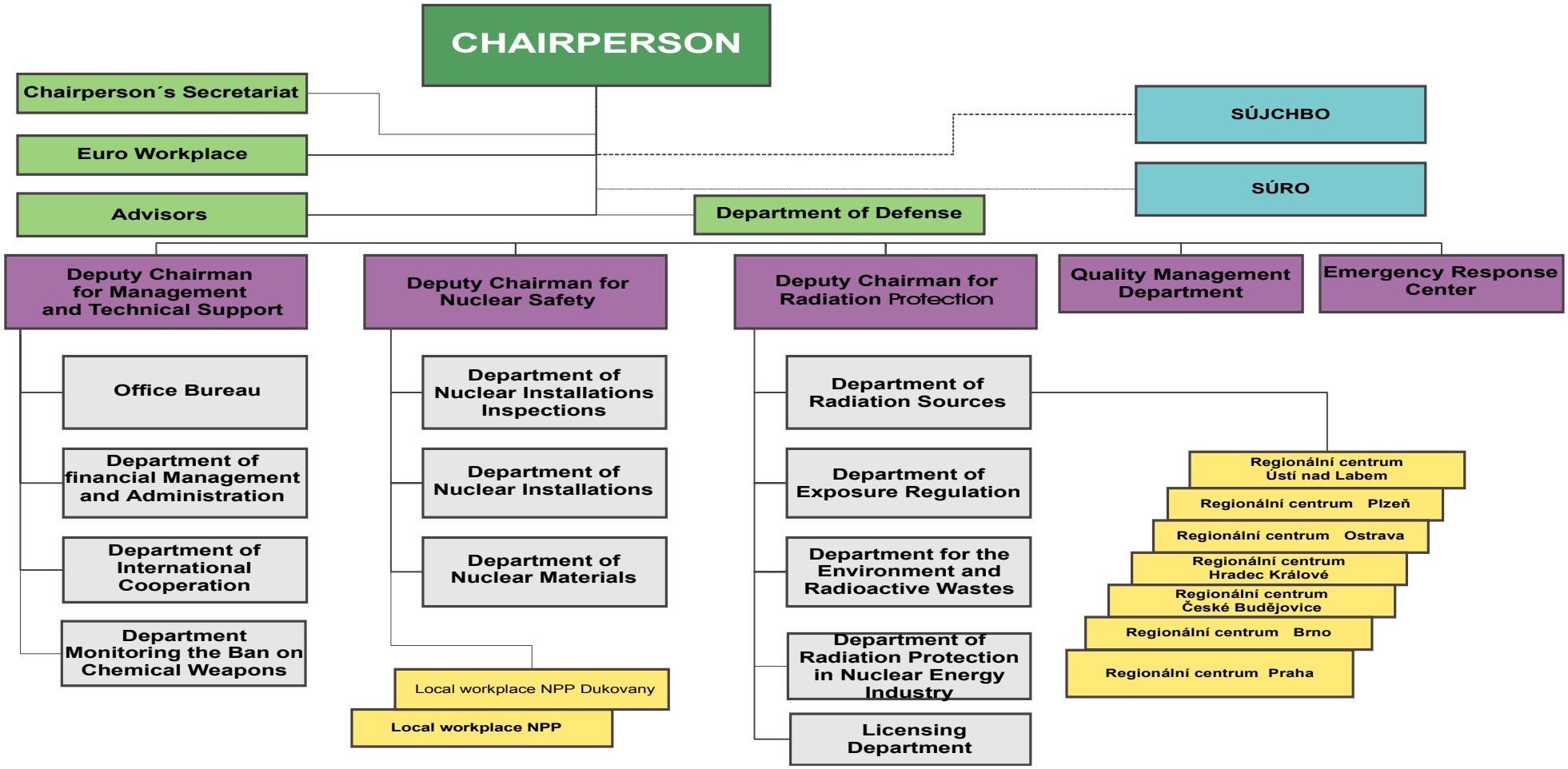



Figure 3.2

### 3.1.5 Relations between the regulatory body other state administration bodies

It is obvious from the above-listed legislative documents and the state administration structure in the Czech Republic, that power of SÚJB are sufficient to carry out its mandate - performance of the state supervision of nuclear safety and radiation protection. At the same time the scope of powers assigned to SÚJB does not either coincide or contradict to that of any other state administration body.

### 3.1.6 Independent assessments of the national regulatory body

Chapters 2 and 3 hereof describe in detail the changes in the supervisory and legislative framework introduced in the second half of 1990s. After their completion and full implementation the Czech republic requested IAEA to independently assess result of the said efforts. The assessment was performed in form of two international expert IRRT missions (International Regulatory Review Team) which reviewed SÚJB in January 2000 and in June 2001.

The first review was a reduced-scope inspection mission focusing mainly on SÚJB activities relating to the licensing procedure for NPP Temelín. The inspection team drew the following conclusions from the mission:

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

Members of the reviewing team handed over several recommendations to SÚJB whose implementation might further strengthen performance of the state supervision. All suggestions and recommendations concern the long-term development of the Office and come 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 (Germany, USA, Great Britain, Finland, Slovenia and Switzerland plus observers from Austria and Armenia) carried out a detailed review of all aspects of state supervisory activities performed by 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, on par with the worldwide accepted practices. In respect to the position of the regulatory body in the state administration structure, the experts highlighted the fact that 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 special areas of supervisory activities, e.g. emergency preparedness practicing and further development in utilization of probabilistic assessment methods in nuclear safety. It was expressly stated, however, that the recommendations were mostly intended for the long-term development of the Office.

The resulting reports from both the IRRT mission have been published on the SÚJB website.

## 3.2 Statement on implementation of the obligations concerning Article 8

The position of the regulatory body within state administration structure of the Czech Republic and existing legislation fully conforms to Article 8 of the Convention.

# 4. Responsibilities of the Licensee - Article 9 of the Convention

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

## 4.1. Description of the current situation

Responsibility of a licensee for nuclear safety of the respective nuclear installation was explicitly established already by Act No. 28/1984 Coll. on state supervision of nuclear safety at nuclear installations (see Chapter 2 of this National Report).

In accordance with the current legislation, the basic principle of responsibility 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 specifies particularly in §§ 17 and 18 of Act No. 18/1997 Coll., on peaceful utilization of nuclear energy and ionizing radiation (the Atomic Act); among other things, the Act in § 17, paragraph 1, letter a) requires a licensee to provide for nuclear safety, radiation protection, physical protection and emergency preparedness of its nuclear installation in general and lists necessary particulars on the licensee's side in respect to the nuclear safety assurance system, 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 license 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 fulfillment of and adherence to the above-mentioned requirements. The rights of SÚJB inspectors of nuclear safety and radiation protection are defined in § 39, paragraph 4, letters b) and c) of the Atomic Act. In agreement therewith the inspectors check on compliance with the requirements for and conditions of nuclear safety, radiation protection, physical protection and emergency preparedness and inspect the nuclear installation conditions, adherence to the Limits and Conditions and operating procedures, and demand evidence of fulfillment of all established obligations.

The joint-stock company ČEZ, a.s., as a license holder for NPP Dukovany and NPP Temelín, has the primary responsibility for nuclear safety of its nuclear installations. The responsibility is delegated from the company central top management to respective managers and the key role in safety is played by the plants´ directors. Nuclear safety assurance ranks among the highest priorities of the licensee. To maintain the required safety standard a whole management system is in place , containing necessary elements of safety management and feedback to verify safety standards , both at the level of individual nuclear installations and at the whole company level.

The licensee has its own inspection system in place to meet requirements of the Atomic Act. A quality assurance program and detailed specifications of powers and responsibilities in other documents are used to guarantee reviewing and observation of the approved working procedures and scheduled periodic tests. Based on the system, in case of an event affecting nuclear safety the event is registered, investigated and corrective measures are introduced to prevent its repeated occurrence. The whole process is regularly and systematically evaluated and monitored by SÚJB inspectors.

As a part of cooperation with similar nuclear power plants currently in operation NPP Dukovany has e.g. an agreement with the Slovak plants – NPP Bohunice and NPP Mochovce. Based on the agreement there is a periodic exchange of experience and knowledge associated with operational audits performed by the partners, similar to WANO Peer Review and OSART.

The ČEZ, a.s. company has introduced an internal system of safety assessment, beyond the requirements imposed by law. The system operates on the central company level and on levels of the individual plants and applies the internationally recognized practices mentioned in the IAEA recommendations and other documents.

Another important obligation of the licensees is their liability for nuclear damage caused by operation of their nuclear installations (§ 33 of the Atomic Act).

## 4.2 Statement on implementation of the obligations concerning Article 9

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.

# 5. Priority to Safety - Article 10 of the Convention

*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.*

## 5.1. Description of the current situation

### 5.1.1 Principle of priority to nuclear safety in the Czech legislation

The principle of "Priority to Safety" has been incorporated into the highest related instrument of the Czech legislation - Act No. 18/1997 Coll. on peaceful utilization of nuclear energy and ionizing radiation (the Atomic Act). Section two of this Act establishes general conditions for the performance of activities relating to the utilization of nuclear energy. § 4, paragraph 3 of the Act unequivocally establishes that:

*"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 implementing regulations which are related to the Atomic Act in the Czech legal system and break down into details its basic requirements. These regulations are listed Chapter 2 of this National Report. These regulations represent generally binding legal documents and they shall be observed by all entities performing and providing for activities related to the utilization of nuclear energy, i.e. - by designers, manufacturers, operators, as well as by the state regulatory bodies.

### 5.1.2 Implementation of principles established in the legislation

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

Its commitment to give "priority to safety" was expressed by the sole licensee for operation and construction of nuclear installations in the Czech Republic - company ČEZ, a.s. - in its safety strategy proclaimed in June 1995 [5-1]. The "Strategy" document declares the company's commitment to nuclear safety and establishes the safety priorities in respect to the construction and operation of nuclear power installations. The document has been drawn in agreement with the basic principles of safety culture described in the IAEA document "Safety Culture" [5-2] . The "Strategy" document was issued as the company top level document, in the form of a resolution by the Board of Directors . In order to communicate it to the ČEZ, a.s., staff, the document was been also published as a leaflet with a foreword by the Chairman of the Board. As a follow-up, both the company's nuclear power plants elaborated their own safety strategies to suit their specific conditions. The ČEZ, a.s., staff at all levels has been made familiar with the company strategy and with strategies of two nuclear power plants with the objective to engage the individuals in the common effort to fulfill the established strategic goals. There are regular efforts to refresh awareness of the "Strategy" principles among the company personnel.

The main strategic goals defined in the "Strategy" have been broken down to detail in the company document "Safety Rules for ČEZ Nuclear Activities" [5-3]. This document defines the main principles of nuclear safety and radiation protection, the adherence to which is binding for all nuclear activities, and establishes relevant responsibilities and authorities within the company structure.

In 1999 the Board of Directors of the joint-stock company ČEZ, a.s. announced its Safety Policy, Environmental Policy and Quality Policy. This step was a logical continuation of the ČEZ a.s. development oriented at open communication with the company employees and with the general public in the Czech Republic.

In 2000 ČEZ a.s. launched a restructuring program and in 2001 a Nuclear Section was established in ČEZ a.s. in order to improve management of nuclear powers plants, their safety and economy of operations. Documents about the new organizational structure are being developed and they will replace the now existing ones. The content and structuring of the new documents is in compliance with IAEA recommendations (NUSS No. 50-C/SG-Q). One of the main goals of the described efforts is the reinforcement of safety.

Safety strategy and safety policy of the nuclear power plant Dukovany [5-4] are closely related to its parent company's strategy and presented in an appendix to the internal document Nuclear Safety Rules [5-5], regularly updated and maintained in agreement with the documents issued by the company management. This document explicitly states that the NPP management is aware of and is recognizes its responsibility for nuclear safety of the nuclear installation, and undertakes that in all safety related activities the best possible results shall be achieved. Nuclear safety shall be given the top priority and nuclear safety requirements shall be viewed superior to operational requirements. To accomplish these objectives NPP Dukovany has developed a complex mechanism which comprises documents of different levels, a system of regular assessments and a system of inspections. While performing their assigned activities all employees shall observe the rules so that probability of the non-

standard events occurrence is minimized. One of the tools for systematic assessment of the level of nuclear safety are nuclear safety factors, as defined in an appendix to the mentioned system document ”Nuclear Safety Rules”. A set of the factors characterizes trends of the nuclear safety level at NPP Dukovany during the past week, month, year. The most significant safety issues related to the operation of NPP Dukovany are addressed by a special dedicated Technical Safety Group. The Group meets on regular basis 4 times a year, its members are representatives of all technical divisions of the plant, representatives of ČEZ Headquarters and representatives of ÚJV Řež and it provides technical assistance to the plant. At its meetings the Technical Safety Group reviews and proposes concepts for solution of significant safety issues. The meetings also evaluate the implemented solutions and the safety factors mentioned above. All information about safety related activities is provided to the regulatory body - SÚJB. An integral part of the strategy is the openness of NPP Dukovany in respect to information disclosed to the general public and foreign subjects on its nuclear safety.

A similar system has been used at NPP Temelín. The Temelín safety strategy [5-5] establishes the main safety priorities of the power plant, emphasizing construction and preparation for the operation. There is also a follow-up document ”Nuclear Safety Rules” in place and some other management documents.

In 2000 the strategy covering the entire service life of the plant was updated and published. In addition to other documents, the safety strategy of NPP Temelín has been based on the Nuclear Safety Principles defined in the documents issued by IAEA: INSAG-3 and INSAG-12. More documents are available, e.g. Nuclear Safety Rules, Radiation Protection Rules, Physical Protection Rules, Emergency Preparedness Rules, Fire Safety Rules, Environmental Protection Rules, Industrial Safety Rules etc. and other related documents applying the safety rules on individual activities at the plant.

The high priority of safety goals is every year clearly voiced by the plant’s management in form of a director’s order. The tasks of highest priority at NPP Temelín in 2001 include safe commissioning and trial operation of Unit 1, start of the Unit 2 commissioning, maintaining the high level of safety culture in all areas (nuclear safety, radiation protection, operational and industrial safety, environment protection, fire safety , physical protection, emergency preparedness).

The ČEZ company and both the nuclear power plants take sufficient care to maintain the high level of nuclear safety and to increase it in a controlled manner; similarly sufficient attention is paid to the financial aspects of safety (see Chapter 7 of this National Report).

***Supervision of nuclear safety***

The Atomic Act defining the ”priority to safety” principle represents for SÚJB a basic legal document for the performance of the state supervision of nuclear safety and radiation protection. As described in Chapter 3 of this National Report, all SÚJB activities, its organizational structure and work procedures are governed by the said principle. The independent position of SÚJB within the state administration, as well as the fact that it is funded directly form the state budget, sufficiently guarantee its main purpose.

The SÚJB authorities (see Chapter 3.1.2 of this National Report) include 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 SÚJB inspections which assess especially the management approach to the safety related issues and how individuals performing safety related activities are motivated in respect to this issue.

***NPP Dukovany – Communication with the general public***

Since 1990 NPP Dukovany has been making substantial efforts to establish friendly and mutually beneficial relationships with the towns, municipalities and population in the region around the plant. Representatives and residents of municipalities living in the plant’s vicinity and the general public have been allowed to inspect the plants premises, including the interim storage of spent nuclear fuel, their questions and comments have been answered and they have been informed about business activities and capital projects aimed at improvement of the plant’s reliability, safety and performance. An information center of the plant opened in 1994 and on average it has been visited by nearly 30 000 people each year, including those coming from abroad. A systematic cooperation between the plant and basic and secondary schools and universities has been under way for number of years.

The establishing and strengthening of mutual ties between the plant and neighboring municipalities includes a substantial financial support to improve their living conditions (development of water distribution systems, sewerage, , waste water treatment plants, local roads, utilities, etc.) and support of various social organizations

and institutions through sponsorship. Credibility of the plant in the eyes of local population in respect to the plant's safety and reliability has also increased due to the established Civil Safety Commission, made up of representatives of local municipalities and with the authority to independently inspect the nuclear power plant and inform the general public about its findings. An automatic telephone information line has been in operation for a few years. The residents may dial its number at any time to obtain the latest information about the plant's operation. More information is available from the ČEZ - NPP Dukovany website. There is also the "Zpravodaj" bulletin informing the population in the region about the latest news from the plant and distributed in 40 000 copies to all households within 20 km from the plant.

The result of the continually developed mutual communication has been nearly 82% approval of the plant's presence among the population in the region and practically the same proportion of those supporting its operation in the future. These figures have been obtained from regular public opinion polls performed by an independent renowned agency. The updated information about NPP Dukovany is available on the ČEZ, a.s. website at www.cez.cz.

***NPP Temelín - Communication with the general public***

Since 1993, apart from personal contacts with the mayors from the vicinity of NPP Temelín, there have been regular meetings between representatives of the Association of towns and municipalities of NPP Temelín region and ČEZ, a.s. NPP Temelín representatives. The meetings have been used to answer questions concerning mainly the plant's completion, its safety, environmental impacts emergency preparedness issues etc., asked by representatives of local residents. Over the period of completion and commissioning of the plant the meetings also included tours in the plant. Through their representatives the mayors receive all latest information from the plant in form of press releases, information materials and publications.

Modern methods of presentation and a number of interactive models in the information center of the plant, situated in a little castle Vysoký Hrádeček and opened in the fall 1997, enable quality and pro-active information transmission to the visitors. There are "tailor-made" programs for different types of visitors, including general public, schoolchildren, students and various professional and specialized groups. From the time the information center was established , i.e. from 1991, until the end of 2000 the plant was visited by ca. 150 000 visitors (in 2000 by more than 23 000 people).

Every households within the emergency planning zone (13 km) receives the plant's information bulletin "Temelínské noviny". Articles in the bulletin are written in a popular form to introduce to the general public topical issues in nuclear power industry, as well as topics dealing specifically with NPP Temelín, particularly its safety, environmental impacts, emergency preparedness, nuclear wastes disposal etc.

Thanks to the relationships developed for many years with the media reporters the general public has been regularly and truthfully informed about the developments at NPP Temelín. Media representatives are provided with the information at briefings and press conferences organized at NPP Temelín and through press releases regularly issued by the plant's spokesperson. After completion of each major commissioning stage media representatives are also permitted to tour the plant.

The latest information about NPP Temelín is also available on the ČEZ, a.s. website at www.cez.cz. The information is in Czech and German since the target group of readers is the German-speaking community. The site includes a "questions&answers" module. There are tens of questions already answered in the module, most of them coming from Austria.

## 5.2 Statement on implementation of the obligations concerning Article 10

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

# 6. Financial and Human Resources - Article 11 of the Convention

*(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.*

## 6.1. Description of the current situation

### 6.1.1. Financial provision of nuclear safety enhancement at nuclear installations in the course of their operation

Act No. 18/1997 on peaceful utilization of nuclear energy and ionizing radiation (the Atomic Act) establishes as one of the general conditions that any person performing or providing for nuclear practices shall have an implemented quality assurance system in place (§ 4, paragraph 7). This condition has been imposed with the objective to achieve the required quality and organizational provision of such activities with regard to their importance for nuclear safety and radiation protection. Quality Assurance Programs for the specified activities shall be approved by the SÚJB.

Documentation of the licensee's - ČEZ, a.s. - quality assurance system includes the commitment to arrange for adequate financial resources available for safety assurance over the whole service life of the company's nuclear power plants. The ČEZ Top Level Quality Assurance Program [6-1] defines that:

*"Sufficient human, financial and information resources shall be available to provide for activities of the company."*
In connection with the ČEZ a.s. Quality Assurance Policy, the provision of adequate resources for major capital projects important for nuclear safety has been described in detail in the relevant procedures and other documents.

Investment programs, developed and approved at the nuclear power plant level, are incorporated into the investment program of ČEZ, a.s. In accordance with the project development and approved documentation, appropriate financial resources are then included into the company's investment budget for the corresponding year.

Funding of the individual projects is provided from the company's unrestricted sources. Possibilities of project funding have been also considered for some projects.

### 6.1.2. 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 four of the Atomic Act (§§ 24 - 31). § 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 a "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, § 25 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."*

Financial means to be used to cover costs of waste (and spent fuel) disposal are deposited by the generators to a special account opened with the Czech National Bank. The "nuclear account" is administered by the Ministry of Finance as one of the accounts of national financial assets and liabilities (§26 paragraph 2) under an Act on state budget regulations, the utilization of which is decided by the government. The funds on the nuclear account may only be used for the purposes specified by the Atomic Act. The amount and method of payments to the "nuclear account" are specified by the Czech government decision, based on a proposal submitted by the Administration of Radioactive Waste Repositories. The Administration is a governmental organization founded in agreement

with the Atomic Act to carry out activities related to radioactive waste disposal. The Act also establishes how the Administration shall be funded and the sphere of its activity.

The radioactive waste management (as well as that of non-active waste, decontamination and technical issues of decommissioning) at ČEZ company's nuclear power plants is controlled by independent organizational units within the safety and technical support departments (i.e. outside the production section). The training of personnel is carried out within the framework of a uniform training system (see also chapter 7.1.3 of this National Report).

***Decommissioning***

The basic obligations of a licensee as specified in § 18, paragraph 1, letter h) of the Atomic Act include the obligation to evenly create financial reserves for the preparation and actual decommissioning of nuclear installations. The amount of this reserve shall be established based on the decommissioning technology approved by SÚJB and then verified by the Administration of Radioactive Waste Repositories. Currently, a proposal for the decommissioning method has been already approved for NPP Dukovany and the financial reserve for decommissioning of "active" buildings (technologies) has been and will continue to be created over the whole period of the plant's service life. The process of creating such a reserve for NPP Temelín will be launched since the plant has been commissioned. A proposal of the decommissioning method for NPP Temelín (one of the documents necessarily submitted with the application for the license) is being developed at the moment.

The ČEZ, a.s. decommissioning documentation is being prepared by a multi-professional team made up of representatives from the ČEZ, a.s., headquarters (coordinator) and from both the nuclear power plants. The team deals with technical, financial, investment and organizational issues of the decommissioning, including provision of the appropriate human resources. Appointing of the team and all activities carried out in this area have been in compliance with the quality assurance requirements established by ČEZ, a.s. in its quality assurance programs for nuclear activities.

***Insurance***

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

At the time when no legislative standard was in place (1994-1997) the issues were covered by a governmental statement (guarantee). In 1997 Act No. 18/1997 Coll. (Atomic Act) came into effect establishing the liability of operators of nuclear installations for damages and charging them with the obligation to obtain insurance (§ 32-38). The liability of operators of major nuclear installations has been established by the Act at 6 billion CZK (ca. 150 million USD)

For the purposes of the insurance the Czech nuclear pool has been established, associating a number of Czech and foreign insurance companies. The pool is a member of the international association - Nuclear Pools Forum. Based on inspections performed by international insurance pools both the Czech nuclear power plants have been insured: NPP Dukovany since 1997 and NPP Temelín since 2000.

The Czech Republic, a pro-active participant in international negotiations in this area, signed on 18 June, 1998 the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage and also the new Convention on Supplementary Compensation for Nuclear Damage. These international instruments have not been so far ratified by the Czech Republic.

### 6.1.3 Rules, regulations and provision of resources for qualification, basic training and regular training (including simulator training) of the personnel whose activities have impact on nuclear power installations safety

***Legislation***

The Atomic Act sets forth conditions under which nuclear energy and ionizing radiation may be utilized. § 17, paragraph 1, letter i) introduces the following general obligation to the licensees:

*" entrust performance of the specified activities only to such persons who fulfill conditions of special professional competence and meet requirements verified in a manner established in a specific regulation, and in good physical and mental health"*

According to § 18, paragraph 1, letter o) the licensee is also obliged to:

*" provide a system of training, verification of competence and special professional competence of personnel in accordance with the importance of the work they perform"*

Preconditions for performance of activities directly influencing nuclear safety are established in § 18, paragraph 3 of the Atomic Act. Such activities may only be performed by physical persons who are physically and mentally fit, with professional competence and to whom SÚJB has granted an authorization for the concerned activities, upon an application by the licensee. Physical and mental fitness shall be checked by the health and psychological institutions specified by SÚJB, in accordance with the requirements to and workload of the persons to be examined.

Professional training of the selected personnel of nuclear installations may, according to § 9, paragraph 1, letter n) of the Atomic Act, be organized by a natural or legal person only on based on a respective license granted by SÚJB. Documentation required for the issuance of such a license is listed in an enclosure to the said Act.

Decree by SÚJB No. 146/1997 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, 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 license for training of selected personnel.

The above described legal regulations have been complemented with the Safety Guide [6-2] published in April 1994 by 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 natural and legal persons whose activities (positions) at nuclear installations are important for nuclear safety, with the objective to minimize risks caused by human failure.

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

The role of a methodical and professional guarantor of training within the ČEZ, a.s. has been entrusted to the department of personnel training and development Brno, which is a part of the nuclear energy personnel section. Its main purpose is to perform basic (classroom) training of personnel for both the nuclear power plants as well as for external suppliers. The department is also, in accordance with the internal management documents, responsible for the establishing of a concept, strategy and system of professional training for all nuclear activities in ČEZ, a.s. company [6-3], [6-4], [6-5], [6-6], [6-7].

Both the nuclear power plants have their own documented systems of training. In respect to nuclear activities the systems represent a complex of mutually related activities, systematically implemented in compliance with the legal regulations valid in the Czech Republic and with the internal management documents.

***The concept of qualified personnel training at NPP Dukovany***

NPP Dukovany, as a nuclear installation operator, is required to assure such professional competence and special professional competence of its employees so that nuclear safety and radiation protection level at the nuclear power plant is not compromised. For each position the quality assurance manual of each respective department establishes requirements for: education, professional experience, health and psychic fitness, probity and especially - for continued professional training of the personnel, before they start to perform their respective activities. The objective of personnel training is to assure that each individual possesses necessary knowledge, skills and habits required for achieving, maintaining and developing the relevant professional competence. The fulfillment of this objective is verified by examinations and then formally confirmed authorizations issued by the employer to perform the concerned activity.

The personnel training system at NPP Dukovany is based on the system of education in the Czech Republic. A significant proportion of employees are university graduates (approximately 30 %) or technical high school graduates (30 %). For this reason the training process at NPP Dukovany focuses on provision of additional special knowledge in the area of nuclear power plants and acquisition of practical professional competence and skills necessary to perform the concerned work. Special attention is paid to the units control rooms operators (selected personnel). Their training is always concluded with examinations before the state examining board (for more details ion the state examining board see Chapter 7 hereof).

The *personnel training* as a process consists of *specific training* and *professional training.* The specific training is further divided into *basic training* and *regular training.* The *professional training* includes *specialized*

*training* and *periodic training.* The mutual relations of the individual training components are shown in Figures 6-1 and 6-2.

The process of personnel training starts with recruitment and hiring. New workers are always selected according to the criteria established in the internal instruction ”Personnel and Social Policy rules” [6-8]. The selection process includes verification of health and psychic fitness of the employees for their future positions. The personnel department NPP Dukovany is responsible for this area.

Another subject involved in the training process is the Training and Educational Center of NPP Dukovany (ŠVS) which provides for training of the plant’s personnel and personnel of its external suppliers, while responsibility for the professional competence (qualification) of employees rests with the respective managers at all management levels. Principles governing the process of personnel training at NPP Dukovany for its own employees and employees of its external suppliers are described in the internal procedure Rules for Personnel Training [6-9]. The Training Center provides for the organization of different types of theoretical, as well as practical training, carries out the training, including appropriate record-keeping and documentation. The Training Center also administers the central files of personnel qualification maintained for each work activity performed at all departments of the nuclear power plant. The Training Center is responsible for application of new training methods and training tools which should improve efficiency of the training.

***Basic, periodic and professional training of personnel at ČEZ a.s. NPP Dukovany***

The purpose of *basic training* is to acquire or to improve special 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. From the viewpoint of nuclear safety the 5 following groups are defined, for:

- management,
- selected personnel,
- employees of technical departments,
- shift and non-shift operating personnel,
- maintenance personnel.

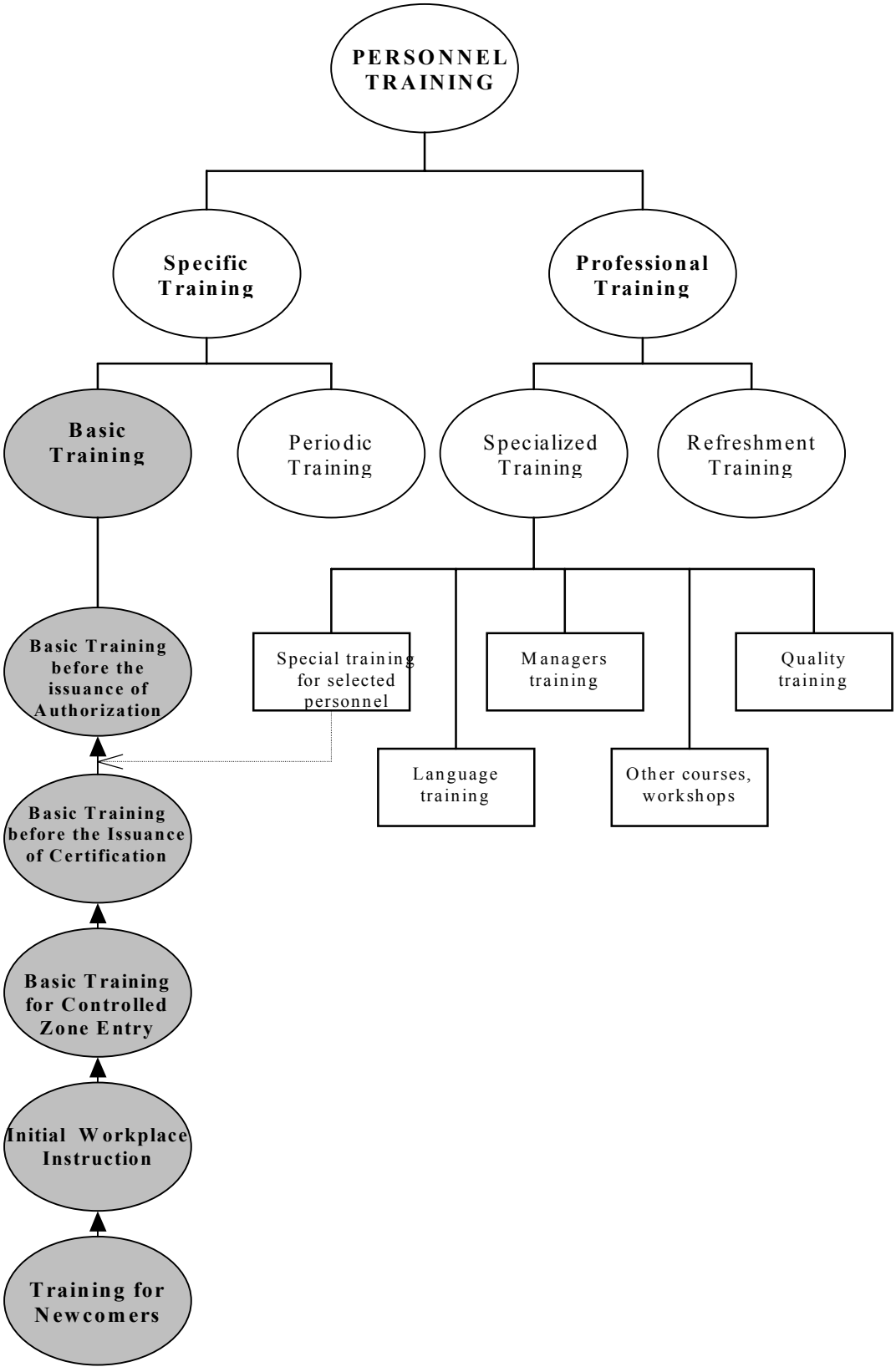
From the viewpoint of radiation protection, three groups are defined in agreement with Decree No. 184/1997 Coll.,:

- selected personnel,
- personnel handling sources of ionizing radiation,
- other employees.

The training is carried out in compliance with the training programs prepared by the plant in cooperation with the training guarantor (Department of Personnel Training and Development of ČEZ a.s. headquarters).

The basic training is carried out in consecutive steps as shown in Fig. 6-1.

**Figure 6-1 Basic Training Position within the Personnel Training System**



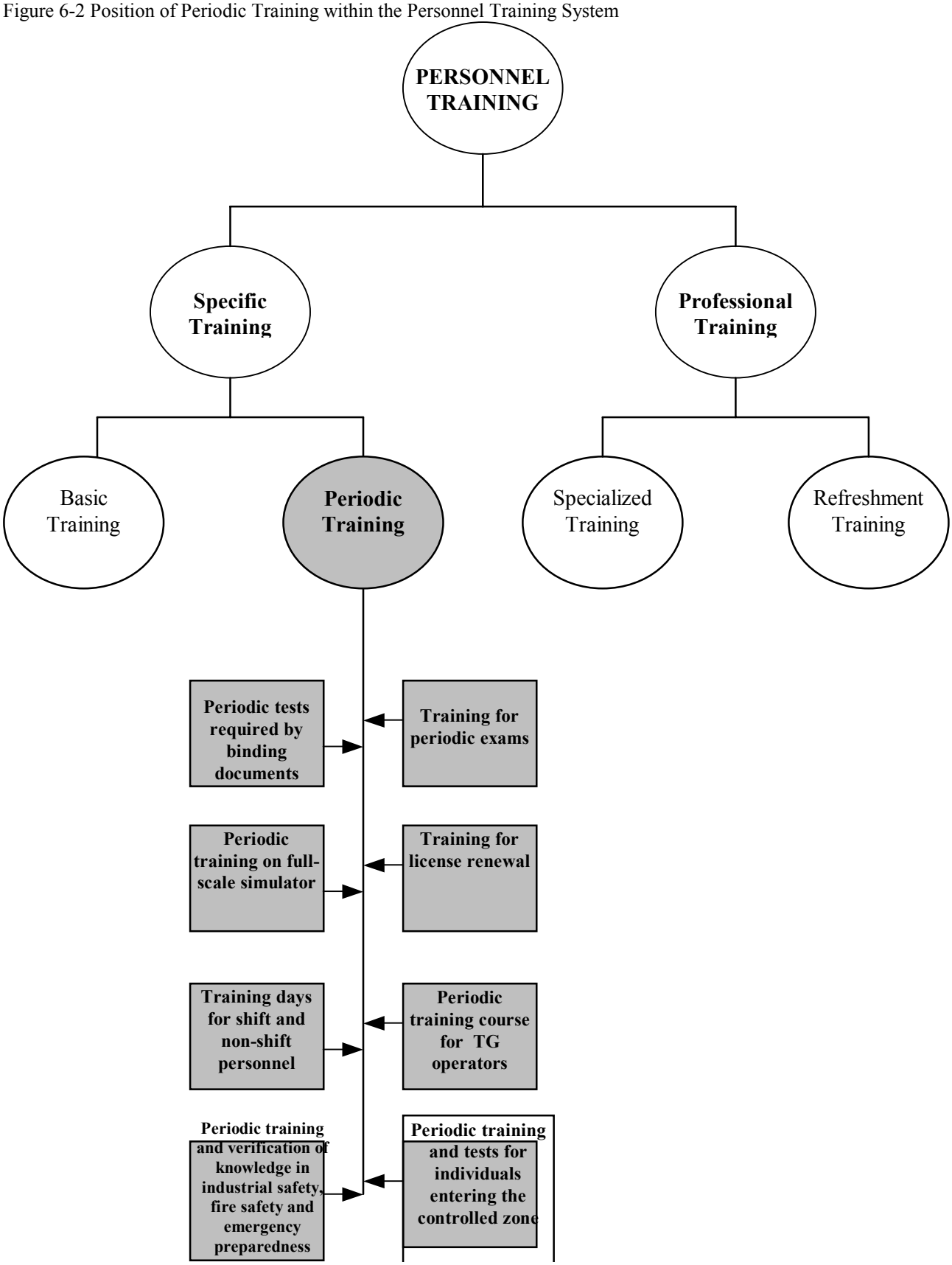
There are the following forms of basic training, depending on the training program, training group and specialization:

- theoretical/classroom training,
- secondments at nuclear power plants,
- training on a full-scale simulator,
- examination to obtain a Certificate
- training for a specific position
- shadowing
- examination to obtain an Authorization
- Authorization for a work activity.

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 90 weeks, depending on the type of work to be performed after training.

*Periodic training* serves to maintain, update or deepen specific professional competence of an employee as required to carry out his/her work. Each employee who performs an activity important for nuclear safety or radiation protection shall undergo periodic training.
The training is carried out in accordance with the approved training programs organized as shown in Fig. 6-2.

Figure 6-2 Position of Periodic Training within the Personnel Training System



There are the following forms of periodic training, depending on the training program, training group and specialization:

- theoretical/classroom training (training days, training dealing with industrial safety, fire protection, emergency preparedness, access to controlled area, etc.),
- training on a full-scale simulator,
- training and examination to obtain Authorization.

Duration of the individual forms of the periodic training varies from several hours to two weeks (for the simulator), depending on the type of work to be performed after training.

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 activities shall undergo the professional training. This training includes some or all forms shown in Fig. 6-1, either through specialized or refreshment training. The exposure to professional training is very important for the 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 courses.

### *Training of ČEZ, a.s. NPP Dukovany Personnel at a Simulator*

A full-scale simulator is used for basic and periodic training of ČEZ, a.s. NPP Dukovany personnel – a multifunctional replica of the control room situated at the power plant site. The training instructors are highly qualified employees of the Training Center of ČEZ, a.s. NPP Dukovany, with at least three years of experience as reactor unit managers and with a special teaching training.

The replica-type simulator is a high-fidelity copy of the operating personnel workplace in the control room, with all counters and operating panels, including all instrumentation (controllers and communicators) and information system screens. 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 control room staff and the instructor is via a closed circuit telephone line. The installation enables to the instructor to listen to the control room personnel and to record their actions with a camera recording system.

Another multifunctional simulator has four identical workplaces. Each of them is provided with three monitors displaying the simulated systems, including measurements and signaling. The operators control all the equipments with a mouse.

The training itself is based on scenarios developed, tested and approved for all tasks to be practiced in each particular course. Each scenario contains goals of the practiced task, description of the initial unit condition, expected steps to be performed by the personnel, simulation method and criteria of the respective successful approach. In case of basic training the scenario includes also a theoretical analysis. The workplace is provided with valid operating procedures in the same scope as in the actual control room.

### *Training of ČEZ, a.s .NPP Temelín Personnel at a Simulator*

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

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

The VVER 1000 full-scale simulator at NPP Temelín was put into operation with a sufficient lead before the first fuel loading. The workplace of operators has been designed identically with the real 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 modern system based on SILICON GRAPHICS computers. The information and control system of the simulator for operators is a customized WDPF system supplied by WESTINGHOUSE. The latter also supplied counters and panels, including instrumentation, for the full-scale simulator while identical counters and panels will be used in the control room.

The full-scale simulator at NPP Temelín enables practicing of the following conditions of the production unit:

- unit start-up from zero to nominal power,
- unit operation at various power output levels,

- unit shutdown from the nominal power,
- liquidation of error conditions of the unit,
- liquidation of emergency conditions of the unit,
- training of manipulations before execution of tests of the technology,

The full-scale simulator is also used to verify selected operational procedures, selected tests and procedures to be performed during physical and power start-up. The simulator is used as a supporting analytical tool in upgrading of the main production unit technology.

The training system is based on the experience with the VVER 440 simulator. The training on the full-scale simulator also observes recommendations made by IAEA [6-10]. The simulator as a technical tool complies with the requirements established in ANSI/ANS 3.5 [6-11].

***Professional training provided to employees of external suppliers***

The process of personnel training in the case of employees of external suppliers is similar to that of the plant's own personnel, while it takes into to account special requirements for activities related to maintenance and repair of the equipment. The principal structure of the training is shown in Figures 6-1 and 6-2. Requirements for the professional competence of external personnel depend on their involvement in the implementation groups. Types of training obligatory for individual employees are established using an expert procedure in compliance with ISO standards, SÚJB Decree No. 214/1997 Coll. and relevant international recommendations. Detailed requirements for each type of training are specified in the internal management documents. The external suppliers are required to have their training system described in their own documents, including a method to prove fulfillment 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 which enables to modify contents and scope of the professional training and to improve its effectiveness. The basic information sources used for a systematic evaluation of the professional training include:

- direct verification of personnel knowledge,
- indirect verification of personnel competence,
- evaluation of the standard of training processes by managers, trainees, instructors, evaluation of training programs, etc.

## 6.2 Statement on implementation of the obligation concerning Article 11

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.

# 7. Human Factors - Article 12 of the Convention

*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 installations.*

## 7.1. Description of the current situation

### 7.1.1 Methods for prevention, determination and correction of human errors

***Legislative requirements***

Act No. 18/1997 Coll., on peaceful utilization of nuclear energy and ionizing radiation (the Atomic Act) in its § 17, paragraph 1, letter b) establishes, as one of the general obligations of a licensee, the obligation to:

*"assess in a systematic and comprehensive manner the fulfillment of conditions set in Article 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 Decree No. 106/1998 Coll. § 14, imposing 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 assessment of human factor impacts is one of the basic components of the process.

***Assessment of human factor impact at ČEZ a.s. nuclear power plants***

Human failure is one of the issues at the nuclear power plants closely followed with a great attention. The results of regular assessments of operational events have shown that a majority of these events were caused by one or another form of human failure, either directly operator's error or human failure resulting from deficiencies in other fields (documentation, design, etc.).

To investigate human failure causes the nuclear power plants apply the ASSET and HPES methodologies. Direct and root causes of the individual events are classified as equipment failures, documentation deficiency or human error. In case an event is caused by a human error the event is further investigated and results of the investigation are recorded in the so called "Human Factor Form".

***NPP Dukovany***

The causes of human factor failure are regularly evaluated at NPP Dukovany in an annual report, along with factors that contributed to the human failure and they are shown in the diagrams below.

The employees involved in the investigation of causes of human failure and members of the Failure Commission have been trained in the ASSET and HPES methodologies.

The maximum effort has been put into monitoring of human factor in respect to the shift operating personnel. The analysis of human errors over the last five years has helped to establish criteria which identify whether the number of shift personnel errors has increased or decreased.

The causes of human failure are confirmed by the commission investigating events at the plant. A detailed analysis of personnel errors involving violation of one of the established criteria is then carried out by the operations division.

Human factor failure in other sections/divisions of the power plant (maintenance, preparation for operation, etc.) is monitored by the department for events investigation. The shares of failures caused by personnel of the individual divisions and departments are monitored and regularly evaluated on quarterly basis.

The share of human failure is evaluated for events significant for safety, events with loss of production, events during unit shutdowns and refueling.

Recording and investigation have been introduced of events which may have occurred (but did not occur). The plant recognizes that causes of the "near miss" events are the same as causes of usual operational events and therefore they are investigated as any other events in the system. The establishing of causes and introduction of corrective measures represent an efficient prevention of such events.

Human failures are remedied with corrective measures. The commission for events investigation regularly checks on the implementation of such corrective measures.

Training days are regularly organized for all employees of the plant, as a part of the general program of work quality improvement. The training days include the information on selected operational events, based on specialization of the trained personnel and with regard to the cases of human failure.

Also obligatory psychological examination performed for selected professions helps to single out workers with the minimum risk of failures caused by carelessness or negligence.

For several years the plant has been systematically developing a new system of operating procedures to guide each operator and warn about the potential risks while providing absolutely unambiguous description of activities. Selected manipulations have been ever more often described in form of check-lists.

***NPP Temelín***

A group to conclude feedback from operational experience has been established within the department of nuclear and operational safety at NPP Temelín.

The results of investigations performed by the group have shown that most events reported in the course of commissioning were associated with human failure, either in form of a direct error made by the operator or a human failure associated with human activities in other areas (documentation, design etc.)

All events reported at NPP Temelín are divided into 3 groups:

1. very serious events from the viewpoint of nuclear safety, operational reliability and potential damage to the plant;
3. less significant events – defects of the equipment without impact on operation and safety of the plant;
5. insignificant events.

A system for events reporting has a sufficiently low threshold and includes also “near-miss” events and “event precursors”.

Direct and root causes are always investigated for each event in the first category. To investigate root causes of events NPP Temelín uses the HPES (Human Performance Enhancement System) and ASSET (Assessment of Safety Significant Events) methodologies.

### 7.1.2 Role of the regulatory body in the human factor assessment

SÚJB systematically monitors the impact of human factor on the operational safety at regular meetings to discuss conclusions of the plant’s so-called ”Failure Commission” (for more details see Chapter 14.1.6 of this National Report) with the operator. On monthly basis SÚJB prepares a report about results of such meetings. The reports are subsequently evaluated from the viewpoint of feasible corrective measures initiated by the regulatory body.

A system of verification of special professional capability for selected personnel of nuclear installations is instrumental in the prevention of human error occurrence. In accordance with the Atomic Act (see chapter 3.1.3 of this National Report) SÚJB shall establish for the purpose state and expert examining boards and identifies activities with immediate impact on nuclear safety and activities especially important for radiation protection.

The verification is carried out in form of an exam before the state examining board. The exam consists of a theoretical written and oral part, and a practical part. The state examining board may decide to skip the practical part in the case of authorization renewal. A failed exam may be repeated by the applicant within a 1 - 6 months period an the specific date shall be determined by the state examining board. Under a respective implementing regulation an individual who has successfully passed the exam before the state examining board is granted a selected personnel authorization by SÚJB for a period of 2 to 4 years.

## 7.2 Statement on implementation of the obligations concerning Article 12

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

# 8. Quality Assurance - Article 13 of the Convention

*Each Contracting Party shall take appropriate steps to ensure that quality assurance programs are established and implemented making sure that specified requirements for all activities important for nuclear safety are met throughout the nuclear installation service life.*

## 8.1 Description of the current situation

### 8.1.1 Quality assurance legislation

***History of the legislation***

As early as in 1979, the former ČSKAE issued Edict No. 5/1979 Coll., on quality assurance for selected equipment of nuclear installations from the viewpoint of nuclear safety (see chapter 2.1.1 of this National Report). The decree established for the first time requirements for the development, approval, implementation and inspections of quality assurance programs for activities performed during planning, preparation, designing, manufacturing, commissioning and operation of nuclear facilities in respect to nuclear safety. Edict No. 5/1979 Coll. established rules for classification of equipment in the nuclear power industry in respect to nuclear safety. The requirements of edict No. 5/1979 Coll. were gradually implemented during the construction of NPP Dukovany.

Subsequently, Act No. 28/1984 Coll., on state supervision of nuclear safety at nuclear installations, established the obligation for an organization responsible for construction and/or operation of a nuclear installation to submit quality assurance programs for approval to the regulatory body and also contained general provisions about the execution of state supervision over their implementation.

In 1990 the original Edict No. 5/1979 Coll. was revised. The new regulation issued by ČSKAE, Decree No. 436/1990 Coll., on quality assurance of selected equipment from the viewpoint of nuclear safety at nuclear installations, used a similar concept as the original one, and made the quality assurance requirements compliant with the then valid legislation. The quality system for designing, manufacturing and construction of NPP Temelín was fully adjusted to meet the requirements of the new regulation. Likewise, the quality system for NPP Dukovany operation was revised to comply with the said requirements.

***Current legislation***

Act No. 18/1997 Coll., on peaceful utilization of nuclear energy and ionizing radiation (the Atomic Act) has amended general conditions for the performance of activities related to the utilization of nuclear energy, radiation practices and actions to reduce radiation exposure. § 4, paragraph 7 establishes as follows:

*" Any person performing or providing for practices related to nuclear energy utilization or radiation practices 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 "*

The relevant implementing regulation is in this case Decree No. 214/1997 Coll., establishing basic requirements for quality assurance of selected equipment (items) and on their safety classification, and giving details of:

- requirements for the introduction of a quality system covering activities specified by the Act,
- requirements for the said quality system,
- requirements for quality assurance of selected equipment (items) in respect to their safety classification,
- requirements for the content of quality assurance programs,
- criteria for classification of selected equipment into safety classes,
- scope and format of the List of Selected Items.

In agreement with § 13, paragraph 5 of the Atomic Act, a license to be issued by SÚJB for specified activities in utilization of nuclear energy and ionizing radiation shall be conditional upon an approved quality assurance program for the licensed activity (see chapter 3.2.1 of this National Report).

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

The first concept of the business strategy was approved by the company's general meetings in July 1995.

The document enabled to guide the company business, communicate to the company bodies and employees the idea about the basic focus of the company in a changing business environment and create conditions for a sustainable and successful development of the company in the long-term prospective. The general meeting of ČEZ, a.s. in June 1999 approved an updated version of the company's business concept until 2005, which is based on the company mission: to reliably meet the demand of customers for electric power and related services, while keeping competitive prices and protecting the environment.

The coming period requires a principal change to take place in ČEZ, a.s. – its transformation into a company competitive on EU markets, in compliance with the requirements of a directive issued by the European Parliament and EU Council (effective since February 1999) concerning the common rules for the internal electricity market.

The concept defines the goals to be achieved by the company within the implementation of its mission – among other things also:

- to have qualified employees accepting the required performance and quality standards, capable and willing to adjust themselves to the changes,
- to provide for a long-term sustainable development of the company, by increasing efficiency of costs management, risk management and management of quality,
- to be a demanding, recognized and sought-after partner of its suppliers, by using a system of suppliers assessment.

The purpose of the company management strategy us to integrate safety, environment protection and quality into a uniform management system functioning as a framework for high reliability, efficiency and credibility of the company management.

In respect to the goals, the strategic development plans in the nuclear power industry emphasize the following:

a) to complete the construction of and launch safely and reliably the operation of NPP Temelín,
b) to create conditions for the beginning and implementation of NPP Dukovany modernization project so that it may be operated for at least 40 years (i.e. until 2025-2030), while complying with the Czech legal regulations and international safety standards applicable for its operation.

The company's quality concept announced by a resolution of the Board of Directors in 1995 consisted of the following tasks:

1. creation of preconditions to satisfy the customers, shareholders and employees;
2. completing and documenting of the quality assurance system;
3. quality assurance for all activities and processes and creation of preconditions for their improvement;
4. assurance of qualified selection, inspecting and assessment of the suppliers ;
5. assurance of mutual and efficient cooperation between all organizational units of the company ;
6. achieving of high quality standards through professional growth and motivation of all the employees and in the environment of appropriate corporate culture.

The quality concept was in 1997 extended with the commitment of the Board of Directors to continually improve the repute of ČEZ, a.s., as a company consistently meeting all its obligations in respect to the environment. The responsibility for quality concept implementation rests with the executive company management and all the managers. The performance of working obligations by the employees is in compliance with the quality system and accompanied by continual efforts to improve all the processes.

In December 2000 the company issued a manual of nuclear activities as a general document to replace the following documents issued earlier: quality assurance programs, particularly the top-level QA program and QA program for nuclear activities. The manual also covers the safety policy, environmental policy and ČEZ, a.s. policy

In connection with the provision of operation and construction of nuclear installations the company carries out the processes and activities, linked with the peaceful utilization of nuclear energy and ionizing radiation, in full compliance with the Atomic Act No. 18/1997 Coll. and all related decrees dealing with the nuclear issues.

One of the important means to fulfill the above-mentioned provisions is implementation of the quality. The quality system of the company is an integral system of principles and requirements in agreement with the quality philosophy of the company and observing the requirements of ISO 9000 and 14000 standards, as well as IAEA recommendations.

The improvement of the quality system is based on the needs of ČEZ, a.s. management and uses features of comprehensive quality management. It focuses on the amended ISO 9000 series standards, issued on 15

December 2000, considering a wide range of company needs, particularly meeting of customers needs and expectations, the internal need of the company to assure necessary management tools, including tools for the assessment of potential risks and benefits, but also mitigation of environmental impacts and, last but not least, to create a system of qualified suppliers in agreement with an existing and recognized international standard while meeting specific requirements in the nuclear area. The company provides necessary human, material, financial, information and other resources for the introduction and continual improvement of the quality management system.

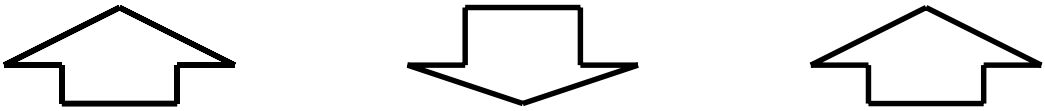
An example of the company's approach to the environment are the results achieved by both the NPPs as well as the gradual introduction of ISO 14000 series standards at all plants operated by ČEZ, a.s., including their subsequent certification now planned for NPP Dukovany in 2001.

### 8.1.3 Quality assurance programs for all stages of a nuclear installation service life

The issues of nuclear safety, radiation protection , emergency preparedness and physical protection are addressed in the management document "Safety rules for nuclear activities in ČEZ, a.s." (see chapter 5.1.2 of this National reports). The rules are binding for all employees working in the area of nuclear activities. The rules define powers and responsibilities, responsibility interfaces between the central headquarters and individual organizational units of the company.

In agreement with § 13, paragraph 5 of the Atomic Act the company has quality assurance programs approved by SÚJB for the licenses activities during the individual stages of nuclear installation service life (8.1.5). The relation between the quality management system and quality assurance program for licensed activities (e.g. operation of the nuclear installation at NPP Dukovany) is shown in the general diagram below:

## Description of quality management system in the Quality Manual



| NUSS 50-C-Q | Quality assurance programs for the licensed activities: operation of a nuclear installation, ..... | Decree No. 214/97 Coll. on quality assurance ... |
|---|---|---|
| 1. **Introduction**<br>Basic information<br>Purpose<br>Applicability<br>Structure | 1. Introductory provisions<br>2. Terms and abbreviations<br>3. Licensee Identification<br>4. Identification of direct suppliers<br>5. List of items important from the viewpoint of nuclear safety and radiation protection<br>5.1 Products (particualrly selected equipment)<br>5.2 Systems | §1 Subject matter and scope<br>§2 Quality system introduction<br>§3 Identification of items, procedures, responsibilities, sources<br>§4 Quality system assessment<br>§5 Requirements for documentation, records on assessment and training<br>§6 Controlled conditions of the processes |
| **2. Management**<br>Quality assurance programs<br>Training and qualification<br>Non-conformity control and corrective measures<br>Document and records control | 5.3 Activities (areas, processes)<br>5.4 Personnel<br>5.5 Links<br>6. Description of the licensee´s quality system<br>6.1 Application of requirements from Decree No. 214/97 Coll. to NPP Dukovany departments<br>6.2 Introduction of the Decree's requirements | §7 Draft contract review<br>§8 Purchasing of items<br>§9 Management of items design<br>§10 Document and data management<br>§11 Identification and traceability<br>§12 Inspection and testing processes<br>§13 Metrology |
| **3. Performance**<br>Work<br>Design<br>Purchasing | 6.3 Management responsibility<br>6.4 Safety and environment protection<br>6.5 Management of resources<br>6.6 Management of working processes implementation | §14 Inspection and test status<br>§15 Control of non-conforming product<br>§16 Corrective and preventive measures<br>§17 Handling, storage, … |
| **4. Assessment**<br>Self-assessment<br>Independent assessment | 6.7 Measurements, analyses and assessments<br>7. Requirements for suppliers´ quality systems<br>8. Schedule of the quality system introduction<br>9. Lists of references and other related documents | §18 Records control<br>§19 Quality audits<br>§20 Personnel training<br>§21 Nuclear installation design<br>§22 Processes of operation of a nuclear installation<br>§23 Special processes<br>§24 Verification and assessment of the processes and items |
| | 10. Method and frequency of verification<br>11. Revisions of and amendments to quality assurance programs | |

The quality assurance programs are elaborated in agreement with § 32 of Decree No. 214/1997 Coll. issued by SÚJB, on quality assurance during activities associated with the utilization of nuclear energy and radiation practices and on establishing of criteria for categorization and classification of selected installations into safety classes.

By now, approximately 80 documents have been developed and approved for NPP Dukovany, mostly for the licensed activities, execution of reconstructions and other changes.

A wide spectrum of activities is covered by the quality assurance program PZJ No. PLNB J 63, item. 080 – see the diagram above. The document includes programs for four types of licensed activities:

- operation of a nuclear installation or workplace with a very significant source of ionizing radiation,
- resumed start-up of a nuclear reactor with criticality introduction after refueling,
- management of very significant sources of ionizing radiation,
- nuclear materials management.

This quality assurance program was developed in 2000 to assure that the requirements specified in e Decree No. 214/1997 Coll. have been introduced and met for the individual activities, and it was subsequently revised in March 2001 and approved by the SÚJB resolution of 28 March 2001, valid until 30 May 2002. The document applies to NPP Dukovany, reactor units No. 1 through 4 VVER 440, type V 213, related buildings, interim storage of spent fuel and to individual items (products, activities, systems, persons and relations) specified in its chapters. The structure of the quality assurance program in respect to the management documents for NPP Dukovany complies with the new series of ISO 9000:2000 standards.

NPP Temelín has issued and observes the management document "Quality Manual ČEZ-NPP Temelín" while the development of quality assurance programs in agreement with the Atomic Act started before the beginning of the active testing of Unit 1 VVER 1000 in 2000 – for the commissioning stages of the nuclear installation. Since then ČEZ, a.s. has successfully continued to submit the quality assurance programs approved by SÚJB for previously agreed stages of power output increase at this Unit in 2001.

### 8.1.4 Application and evaluation of quality assurance programs efficiency

ČEZ, a.s., has established responsibilities for the control and verification of quality for all processes and at all levels. Responsibilities in respect to equipment quality and process verification are described in the relevant documents which are an integral part of the documented quality system. The Nuclear Power Section is responsible for the development of the quality system and co-ordination of its implementation within the company as a whole, as well as for the evaluation of its effectiveness. Responsibilities for the actual implementation rests with all managers throughout the company. Each employee is responsible for the quality of his/her work. Individuals who perform inspection and verification activities have adequate authority to identify discrepancies and, if necessary, to require that remedial measures are taken. The required level of quality is verified by other employees than those performing inspection and verification activities. All company employees are encouraged to submit proposals on upgrading and modifications of the quality system.

Regular training of the company employees is understood as an investment into quality. A uniform training program for ČEZ employees at all management levels is used in the area of quality assurance and quality improvement. The training program for the management and other employees is based on the ČEZ, a.s. quality concept. Its objective is to achieve general understanding of the quality system and all its tools and methods by the employees in order to make them involved in the process of quality assurance and quality improvement and make them participate in the development, implementation and improvement of the quality system.

At the end of each calendar year the quality system efficiency is assessed and the system is subsequently updated. Managers at all levels periodically evaluate all processes and procedures within their responsibility with the objective to review their actual condition and efficiency. The quality systems at Dukovany and Temelín nuclear power plants are evaluated on annual basis.

External audits of the quality systems with the suppliers as well as internal audits, performed by qualified auditors in accordance with the written procedures, represent an important part of the company's inspection system. Company managers use results of the quality audits to take necessary corrective, preventive and remedial measures.

### 8.1.5 Current quality assurance practices applied by the state regulatory body

SÚJB, in accordance with § 39, checks compliance by the licensees with the Atomic Act, including the quality assurance requirements mentioned above. Whenever deemed necessary, the inspection activities are extended to include the subcontractor. The inspection activities focus both on the system and on quality assurance of particular selected items. The SÚJB unit primarily performing this activity the section for assessment of nuclear installations (see the SÚJB Organizational Chart - Fig. 3-2).

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

- siting,
- design,
- construction,
- individual stages of commissioning,
- operation,
- start-up after refueling,
- reconstruction and other changes with a potential impact on nuclear safety, radiation protection, physical protection and emergency preparedness,
- decommissioning,
- management of ionizing radiation sources
- radioactive waste management,
- radioactive material management,
- training of selected personnel.

In accordance with the Atomic Act an approved quality assurance program is one of the preconditions for the issue of a license for the activities specified in § 9, paragraph 1 (see chapter 3.1.2 of this National Report). Criteria for the assessment of quality assurance programs are established in Decree No. 214/1997 Coll. and other binding regulations and standards.

SÚJB also approves the List of Selected Items, 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 Decree No. 214/1997 Coll.:

To issue a license for a nuclear installation siting SÚJB shall consider the following, as part of the initial safety report.:

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

To issue a license for the construction of a nuclear installation SÚJB shall consider the following, as part of the initial safety report.:

- quality assurance method in the preparation for construction,
- quality assurance method in the construction implementation,
- safety assurance principles for the following stages.

For the approval for first fuel loading, SÚJB shall consider quality evaluation of the selected items, as part of the Pre-Operational Safety Report.

## 8.2. Statement on implementation of the obligations concerning Article 13

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 will be fulfilled over the whole period of the service life of a nuclear installation. The requirements specified in Article 13 of the Convention are fully complied with.

# 9. Safety assessment and verification - Article 14 of the onvention

*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 experience from operation and significant new safety information, and reviewed under the authority of the regulatory body;*

*(ii) verification through analyses, surveillance, testing and inspection is carried out to check on whether the physical state and operation of a nuclear installation continually comply with its design, applicable national requirements and operational limits and conditions.*

## 9.1 Description of the current situation

### 9.1.1 Licensing process and associated analyses during the project's individual stages (siting, design, construction, operation)

The licensing process legislative framework is defined by Act No. 50/1976 Coll., on land planning and building regulations (the Building Act), Act No. 18/1997 Coll., on peaceful utilization of atomic energy and ionizing radiation (the Atomic Act) and their implementing regulations.

In the case of a nuclear installation construction, the Building Act established three-stage procedure comprising a site decision (siting), construction permit and operating license (permanent operation). Issuance of these resolution/permits is within competence of the respective local department of planning and building control. The resolutions are conditional upon positions issued by specialized regulatory bodies, including SÚJB. For more detailed information see chapter 2.1.2 of this National Report.

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 SÚJB license to be issued in an administrative procedure which is independent of the above described procedure required under the Building Act. The Atomic Act explicitly forbids to launch siting, construction, operation and other activities at nuclear facilities requiring the SÚJB license before the respective SÚJB license becomes legally effective. For more details see chapter 3.1.2 of this National Report.

That means that the approval procedure, besides the three-stage process mentioned above, also includes a number of other partial licenses issued by the SÚJB in accordance with the Atomic Act during different stages of the service life of a nuclear installation.

According to the provisions of § 17, letters a) and b) of the Atomic Act, a licensee shall verify nuclear safety during all stages of the installation's service life (in the scope appropriate for the particular licenses), 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 documented. The contents of the documentation is specified in Appendices to the Atomic Act. Safety assessment is, in compliance with the Atomic Act, reviewed by 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 12, 13 and 14 of this National Report.

The following implementing regulations complement the Atomic Act to establish basic criteria for nuclear safety assessment of a nuclear installation during different stages of its service life:

- Decree No. 215/1997 Coll., on the criteria for siting of nuclear installations and very significant sources of ionizing radiation,
- Decree No. 195/1999 Coll., on requirements for nuclear installations in respect to nuclear safety, radiation protection and emergency preparedness,
- Decree No. 106/1998 Coll., on nuclear safety and radiation protection assurance during commissioning and operation of nuclear installations, 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 of safe operation (Technical Specifications).
- Decree No. 214/1997 Coll., on quality assurance in activities related to the utilization of nuclear energy and in radiation practices,

Practical application is described below 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. It includes in particular:

- systematic monitoring of nuclear safety (supervision, inspections, tests),
- deterministic evaluation of nuclear safety (Operational Safety Report),
- probabilistic safety assessment (so called "living" Probabilistic Safety Assessment Study).

### 9.1.2 Continual monitoring and periodic assessment of nuclear safety at nuclear installations

***NPP Dukovany***

Continuous monitoring of the unit's nuclear safety performed by the operator focuses in particular at observation of the Limits and Conditions of safe operation [9-1].

Inspections of compliance with additional requirements are performed during outages, dealing with the procedures of works and manipulations on the primary circuit technological equipment. The inspections are performed by the staff of the nuclear safety section and managers of other centers whose personnel or, if applicable, contractors, carry out works during the outages.

The information describing the level of nuclear 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 nuclear safety, radiation protection and reliability of NPP Dukovany operation).

The information on nuclear safety assurance is presented both in textual and graphic forms. The latter form uses indexes containing the information about safety systems reliability, conditions of certain equipments in general, environmental impact of NPP Dukovany operation and about compliance with the established principles for the given area (fire protection, industrial safety).

For the day-to-day assessment NPP Dukovany uses a risk monitor which evaluate the risk (probability of core meltdown) caused by unavailability of the unit components at the nominal configuration (operation on power).

Since 1995, the unavailability has been monitored at all four Dukovany units. Impact of individual components unavailability on nuclear safety is assessed using the absolute value of core meltdown probability and a cumulated risk value which is a product of the increase in the core meltdown probability above the basic level and the duration of the component unavailability.

The monthly reports on internal supervision of nuclear safety include diagrams of the core meltdown risk for the individual NPP Dukovany units and evaluation of individual unavailability contributions to the risk.

The annual reports on nuclear safety and reliability of NPP Dukovany operation include assessments of major events of equipment unavailability – the most significant contributors to the cumulated risk of NPP Dukovany in the corresponding year.

The risk monitor was also applied to analyze permitted durations of the equipment unavailability and some combinations of concurrent unavailability as defined in the above-mentioned Limits and Conditions of safe operation [9-1] and in selected hypothetical scenarios.

Results of the assessments in 2000 - indicating trends in the indicators - are shown in Appendix 7 to this National Report.

***NPP Temelín***

The safety of NPP Temelín operation is assured through compliance with the approved Limits and Conditions of safe operation [9-2]. The requirements established therein are based on the results of safety analyses which demonstrate the plant's safety under the conditions of abnormal operation and accidents. The document Limits and Conditions of safe operation (LaP) was approved by SÚJB on 4 July 2000 as a basic precondition to obtain a license for the first fuel loading into Unit 1.

At NPP Temelín independent monitoring and assessment are performed in agreement with the Limits and Conditions. The monitoring procedure is specified in the quality assurance document – Limits and Conditions, independent monitoring and assessment of operational safety at NPP Temelín [9-3].

The document establishes responsibilities for activities concerning independent verification in agreement with the Limits and Conditions during operation., compliance with the testing criteria, compliance with the Limits and Conditions requirements in the course of shutdowns and before an equipment is declared operable after maintenance.

***Deterministic nuclear safety assessment (Operational Safety Report)***

***NPP Dukovany***

The results of nuclear safety assessments at individual units are in compliance with the original and current legislation documented in the safety reports.

As a result of changes and modernization at the Dukovany units, validity of the original Pre-operational Safety Report, a document supporting the issuance of the license for permanent operation of the Dukovany units, has been limited. Also the methods used to demonstrate safety have been upgraded since then as a result of scientific and technological progress. Moreover, a long-term experience in now available from operation of the units.

In 1991, the state regulatory body (the then ČSKAE) in its resolution No. 154 established conditions to be met by the operator of NPP Dukovany in order to obtain a license to continue operation of Unit 1, i.e. after 10 years of operation. One of the conditions was to submit an updated Safety Report, not later than six months before applying for a license to continue the operation, which should present the status of nuclear safety assurance at NPP Dukovany units using the current level of science, technology and experience from the operation.

The safety evaluation in the mentioned updated Safety Report includes a systematic and deterministic analysis of potential failures of the structures, systems and components and identifies consequences of such failures. The results have been processed to the level of detail necessary for independent assessment of the contents, depth and conclusions of the deterministic analysis. The Safety Report submitted to SÚJB contains a description of the plant enabling independent assessment of its safety features. It also contains information on the site characteristics the design must comply with, detailed information on main characteristics of the systems, especially those used for reactor control, shutdown, cooling, retention of radioactive substances , i.e. mainly safety systems. It describes analyses of the design basis accidents and presents their results.

In the following years Operational Safety s Reports were prepared also for the remaining three Dukovany units.

Each Operational Safety Report has been regularly updated.

***NPP Temelín***

The Pre-operational Safety Report for Unit 1 NPP Temelín [(9-4] is the basic document of the licensing process. Each change performed during the commissioning is carefully considered by the operator to substantiate the change from the viewpoint of conclusions defined in FSAR. The commissioning process itself is managed to aviod deviation from the conclusions verified by safety analyses.

A system for NPP Temelín modification is applied at NPP Temelín during commissioning where a number of adjustments is performed jointly by the operator and suppliers while three categories of modifications have been defined in respect to safety. Modifications affecting safety and altering the employed FSAR assumptions shall be approved by SÚJB before their implementation. Responsibilities of the individual departments of the plant in assessment of the modification status are specified in the quality assurance document [9-5]. All the required modifications are evaluated by respective departments of the plant. Responsibilities of suppliers in the implementation of modifications are established within the respective inspections. For implementation of changes the plant has an established inspection system for the suppliers.

***Probabilistic safety assessment at NPP Dukovany (the so-called "Living" PSA Study)***

The first probabilistic safety assessment study (PSA) level 1 for NPP Dukovany was completed in 1993, as a result of a program sponsored by the Czech government and performed by several Czech organizations under the leadership of the Nuclear Research Institute (ÚJV, a.s.) in Řež. The study considered an internal initiating event during reactor operation at the nominal power. Since then the level 1 PSA has been broken down into more detail and extended. Currently the level 1 PSA study has established the resulting core meltdown probability for NPP Dukovany at 1.74 $10^{-5}$ reactoryear and it is expected that the value will further improve once all planned modernizations are completed.

In 1994 the American company SAIC reviewed the study and prepared its own PSA level 1 model for the purposes of the first risk monitor development. Since 1995 the monitor has been used to assess core meltdown probability caused by unavailability of components at the individual units of the plant. In 1999 the monitor was updated in agreement with the current status, in cooperation with Sceintech and ÚJV, a.s. Řež.

Further development of the PSA level 1 model has been contracted to ÚJV Řež, including a more detailed evaluation of human factor. In the following years the study was extended to include other initiating events, e.g. internal fires, floods and consequences of a high energy pipeline rupture. Similarly, modifications implemented at

the plant, which included the design changes, equipment replacement and alterations in the operating procedures, have been gradually incorporated into the model.

The PSA level 1 results served as inputs for the reduction of impact of the most significant sequences. Further changes in the design were made, some equipment was replaced and new emergency procedures were developed. All the planned modifications of NPP Dukovany units relating to nuclear safety were evaluated, based on the PSA results, and prioritized. The PSA level 1 results have been also used in the development of a new procedures dealing with emergency conditions.

The first results of the PSA level 2 establishing probability of the radioactivity release into the environment during postulated events were handed over to SÚJB in April 1998. The study was funded by an American grant (provided to SÚJB) and performed by SAIC in co-operation with ÚJV,a.s Řež, based on the PSA level 1 developed in 1994. For VVER type reactors the level 2 study represented a pilot project. The level 2 study will be continually specified further, however it has already provided a very valuable information.

The so-called "living" PSA level 1 study is a permanent program. The work covers the following two main areas:

- updating of the study, i.e. modeling of the implemented modifications, updating of specific data for the units and incorporation of more accurate analyses into the model, etc.,
- extending of the study scope.

***Probabilistic safety assessment at NPP Temelín ( PSA Studies level 1 and 2)***

The probabilistic assessment of NPP Temelín Unit 1 was performed by a PSA Temelín team which included PSA experts from the plant, ÚJV, a.s. Řež, EGP, a.s., RELKO, EQE and other Czech experts, while the project was managed by experts from NUS Corporation (USA).

The purpose of the PSA project was to assess serious accidents, to understand the most probable sequences of accidents that may occur at the plant, to acquire quantitative understanding of the total probability of core damage and release of radioactive substances and to establish the main contributors to such releases. The PSA project included the level 1 at power and during outages, as well as external events, while the analyses at level 2 established the source terms. The potential risks of sabotage, war and external impact of the accidents were not assessed.

The resulting probability of core damage at NPP Temelín due to internal events has been found similar to those at other NPPs with PWR. It has been found that results from NPP Temelín are approximately in the middle of the range of results obtained from various NPPs with PWR. However, since the design of many systems at the plant and the knowledge of thermohydraulic characteristics of the core and primary circuit were in a process of modification during the preparatory stage of PSA, many conservative assumption had been adopted. Some information used in the analysis, concerning dominant events resulting in core damage and external risks, had been obtained from the earlier steam-generator design and some information on I&C, cabling installation and control room was not available at the time when the analysis was performed..

The current PSA analyses at NPP Temelín will be based on the current status of the plant. The analyses will be updated in 2001-2002 and will represent the most recent knowledge on the plant's response to emergency situations, based on its current design, operational condition and after the introduction of many measures. This will enable to assess the impact of safety related measures at NPP Temelín, using the core degradation frequency (CDF) and leakage of radioactivity frequency (LRF) and thus acquire a more realistic estimate of the current safety level in the commissioning stage. It is expected that the measures will result in a substantial reduction of CDF and LRF. Available PSA models for all operational conditions and levels 1 and 2 have been converted and employed in the NPP Temelín safety monitor. The software along with the converted PSA models will enable to analyze in real time the impact of actual and planned configurations of the plant, including maintenance conditions and equipment testing and, as a result, to identify the risk levels without a detailed knowledge of the PSA methodology. Once the updated study is completed the software will be used for the purposes of maintenance optimization during operation and outages.

### 9.1.3 Preventive maintenance, in-service inspections of main components, evaluation of ageing

The nuclear power plants Dukovany and Temelín have implemented the following three basic programs with the objective to monitor and to maintain the level of nuclear safety:

- preventive maintenance program,
- in-service inspections program,
- program monitoring ageing of the main components.

***Preventive maintenance program***

Maintenance is carried out in agreement with the established maintenance program, including the preventive maintenance program, for individual equipments. The methods and scope of maintenance depend on the level of safety and reliability required for the equipment.

The basic maintenance methods applied include:

- preventive maintenance further divided into:
  - periodic preventive maintenance,
  - predictive maintenance,
- corrective (ad-hoc) maintenance.

The preventive maintenance is carried out in the prescribed cycles, i.e. regular time intervals defined by real time or number of hours in operation and also based on the actual condition of the equipment as identified by audits, inspections and diagnostic measurements. The scope depends on the maintenance type, i.e. a routine repair, medium-sized repair or major overhaul. Results of the inspections, monitoring, nuclear safety and reliability assessments as well as results of the operational diagnostics are employed to evaluate and to optimize the maintenance program for each given equipment.

The maintenance scope and funding are planned in a range of plans, from long-term 5-years maintenance plans up to daily maintenance plans. A special information system is applied for the purpose of the actual management of maintenance.

Preventive maintenance (as well as repairs) is often contracted to qualified companies – mostly manufacturers of the equipment (Vítkovice Ostrava, Škoda Plzeň, Sigma) - and to the companies established through transformation of the plant's own maintenance section. All those activities are carried out in accordance with the established procedures and under supervision.

***In-service Inspections Program***

In-service inspections are carried out in accordance with an inspection plan approved by SÚJB for safety related components as selected by the plant designer. The selection has been also approved by SÚJB. The inspection programs for individual components were proposed by the equipment manufacturers and included into the so-called "individual" quality assurance programs for each component.

The following methods are used for the inspection purposes: visual inspection, fluorescent penetrant inspection, magnetic powder, eddy currents, ultrasound transmission, ultrasonic thickness measurement, dimension measurement, tightness and pressure tests, diagnostic measurements. The range and number of the methods depend on the particular component's importance.

Inspections performed by automated methods are, as a rule, contracted from external suppliers, usually manufactures of the investigated equipment (Vítkovice Ostrava, Škoda Plzeň) or from specialized companies (ÚJV, a.s. Řež, VÚJE Trnava, TEDIKO Chomutov). Non-automated inspections are performed by the plant's own personnel.

Before a unit is put into operation results of the inspections are reviewed by a group of professionals made up of representatives from regulatory bodies (SÚJB, ČÚBP, ITI,...), equipment manufacturers and internal plant supervisors.

***Components life monitoring program***

A components life monitoring program focuses particularly on the main plant components important for nuclear safety.

In respect to the primary circuit equipment residual service life is monitored of the reactor pressure vessel, including its internals, of steam generator, main circulation pumps and pressurizers; the residual service life is also monitored for the main circulation pipeline. Input data into the service life monitoring program are the measured process parameters (especially temperature, pressure and dose load), as well as information obtained from non-destructive in-service inspections, chemical data to identify a particular corrosion environment, as well as material and physical properties.

For the secondary circuit a similar program focuses on the erosive corrosion of piping systems.

### 9.1.4 Regulatory practice

SÚJB is obligated and granted the authority by the Atomic Act to verify and to assess nuclear safety (see chapter 9.1.1). SÚJB discharges the said obligation through:

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

The verification of a nuclear safety status by SÚJB is based particularly on its inspection activities. § 39 of the Atomic Act establishes authority for SÚJB inspectors to carry out inspection activities. § 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 § 40, 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 details - see chapter 3.1.2 of this National Report.

Essentially, there are three different forms of inspection activities performed by 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. Their 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. The routine inspections are mostly performed by inspectors residing at the individual nuclear installations and dedicated particularly for such activities.

In case of the planned specialized inspections a regular semi-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 and safety analyses.

The inspections are usually carried out by a team of inspectors, made up of resident inspectors and inspectors from the Central (Prague) 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.

SÚJB assesses the level of nuclear safety also in the course of the so-called ”licensing” procedure to issue licenses for activities identified in the Atomic Act. Moreover, for NPP Dukovany SÚJB also assesses its level of nuclear safety assurance within the following activities:

- assessment of the periodically submitted Operational Safety 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 SÚJB in the area of nuclear safety verification and assessment are regularly submitted to the government on annual basis. The results are also made available to the general public.

## 9.2 Statement on implementation of the obligations concerning Article 14

In agreement with the requirements of Article 14 of the Convention, the Czech licensee performs comprehensive and systematic safety evaluations before a nuclear installation construction, commissioning and throughout its whole service life. The evaluations are documented and updated on as needed basis, to reflect operational experience and significant new scientific and technological information relating to nuclear safety and, in compliance with the Act, assessed by the responsible regulatory body.

# 10. Radiation Protection – Article 15 of the Convention

*Each Contracting Party shall take appropriate steps to ensure that in all operational conditions the radiation exposure of the workers and the public caused by a nuclear installation is kept as low as reasonably achievable and that no individual is exposed to radiation doses exceeding prescribed national exposure limits.*

## 10.1 Description of the current situation

### 10.1.1 Summary of legislation relating to radiation protection

Radiation protection in the Czech nuclear installations is regulated by Act No. 18/1997 Coll., on peaceful utilization of nuclear energy and ionizing radiation (the Atomic Act) and its implementing regulation No. 184/1997 Coll., requirements for radiation protection assurance.

The legislation in the radiation protection area is consistently based on internationally recognized radiation protection principles which observe recommendations of renown international non-governmental experts organizations and especially recommendations issued by the International Commission on Radiological Protection (ICRP) No. 60 (1990), as well as on the related international fundamental standards for radiation protection approved by intergovernmental organizations, including International Atomic Energy Agency. The mentioned legal regulations were developed while taking into account the required harmonization of the respective Czech Republic's legislation with the corresponding directives of the European Union, particularly with the European Commission Directive 96/29 Euratom of May 13, 1996.

It is expected that the full harmonization with the EU legislation will be achieved through the currently developed amendment to the Atomic Act and its implementation decrees.

The Atomic Act establishes a system protecting the population and the environment against adverse effects of ionizing radiation. General obligations associated with the utilization of nuclear energy and ionizing radiation are with radiation practices are established in § 4 of the Act. They include particularly the following general obligations:

*" Anybody who utilizes nuclear energy or performs radiation practices or actions to reduce exposure from radiation accident, shall justify such activities by their benefits, which shall offset any possible existing or potential risks (the so- called justification principle).*

*"Anybody who utilizes nuclear energy or performs radiation practices or actions to reduce exposure from radiation accidents, shall maintain such a level of radiation protection so that risks to life and health of people and to the environment are as low as reasonably achievable, under the given economic and social factors ..." (the so- called optimization principle, ALARA principle.)*

" *Anybody who performs selected radiation practices, including utilization of nuclear energy shall make sure that the total sum of exposure caused by a potential combination of exposures from radiation practices does not exceed the exposure limits established by SÚJB determined. (the so-called dose limitation principle).*

" *The exposure of any individual involved in actions responding to a radiation accident shall not exceed the tenfold of the limit established for the exposed workers, unless human lives are at risk or prevention of further development of the radiation accident with potential extensive social and economic consequences ...*

*".. adopt measures to prevent or reduce exposure during a radiation accident whenever the expected exposure of persons nears to the levels where their health is immediately impaired by the exposure or whenever such measures are expected to bring more benefits than drawbacks..."*

The Atomic Act established the obligation to obtain a license from SÚJB for practices listed in § 9 (siting, construction, stages of commissioning, etc.). For more details see chapter 3.1.2. of this National Report. The same applies for the release of radionuclides into the environment and for radioactive waste management. § 17 - 19 establish a number of additional obligations for the licensee. In respect to radiation protection at nuclear installations the obligations include in particular:

- assure radiation protection in the scope required by the particular licenses and assure systematic supervisions of compliance with the radiation protection requirements,
- comply with conditions specified in the license issued by SÚJB, proceed in accordance with approved documentation and promptly investigate any violation of such conditions or procedures, and adopt corrective measures to prevent that the situation occurs again , including the obligation to promptly report all cases to SÚJB where any exposure limit has been exceeded,

- comply with technical and organizational conditions for safe operation of nuclear installations as established in the implementing regulations,
- participate in the functioning of the National Radiation Monitoring Network to the extent established in a government order,
- promptly report to SÚJB any change or event affecting nuclear safety, as well as any change in circumstances decisive for issuance of the license,
- provide the general public with information on nuclear safety and radiation protection assurance, unless such information is subject to state, professional or business secret,
- monitor, measure, evaluate, verify and record all values, parameters and facts important for radiation protection, in the scope established in the implementing regulations, including radiation monitoring of individuals, workplace and its vicinity, keep and file records on the mentioned facts and submit the recorded information to SÚJB in a manner specified in an implementing regulation,
- reduce the produced quantity of radioactive wastes and spent nuclear fuel to the minimum necessary level,
- prepare and hand over to the Administration of Radioactive Waste Repositories (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,
- keep records about radioactive wastes, structures by type of waste, in such a manner that all characteristics affecting its safe management are apparent,
- provide for regular medical checkups of personnel who handle ionizing radiation sources,
- provide a system of training, verification of competence and special professional competence of the personnel in accordance with the importance of the work they perform.

In the event of a radiation accident the licensee is obliged to the extent and in the manner determined by the internal emergency plan approved by SÚJB:

- promptly notify the relevant District Authority, SÚJB and other relevant bodies specified in the internal emergency plan, about the occurrence or suspected occurrence of a radiation accident,
- in the event of a radiation accident promptly provide for a warning signal to the public within the emergency planning zone,
- provide for prompt liquidation of radiation accident consequences in the premises where the licensee performs its activities and implement measures to protect employees and other persons from the effects of ionizing radiation,
- provide for the monitoring of exposure of its employees and other persons and release of radionuclides or ionizing radiation into the environment,
- inform relevant authorities about results of the monitoring, the actual situation and its anticipated development, measures adopted to protect the employees and the population, measures adopted to liquidate the radiation accident and about actual and anticipated human exposure,
- monitor and regulate exposure of the employees and persons involved in liquidation of the radiation accident within the premises where the licensee performs its activities,
- assist in liquidation of the radiation accident consequences within its facility,
- in case of a radiation accident participate in activities of the National Radiation Monitoring Network .

The licensee shall also submit to the respective District Authority supporting documents for the development of an external emergency plan and cooperate with it to ensure emergency preparedness in the emergency planning zone; the licensee shall also at its expense participate in the provision of the National Radiation Monitoring Network activities, provide antidotes to the public in the emergency planning zone and to employees of the respective installation and workplaces, provide for press and information campaigns to make sure that the population in the vicinity has been prepared for a radiation accident and provide for a warning and information system for the population in the vicinity, all within the scope of the government order dealing with the emergency planning zone. The licensee shall participate in liquidation of a radiation accident within the emergency planning zone.

The Atomic Act also establishes rights and obligations in respect radioactive waste management. Depending on a level of contamination the Act distinguishes between three basic categories of radioactive wastes. The first category includes little contaminated wastes so that their radioactivity can be disregarded. The second category includes more contaminated wastes which may be discharged into the environment following a relevant administrative procedure, based on a permit issued by SÚJB and in a manner and under conditions specified therein. The third category includes wastes 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 by law entrusted to the Administration of Radioactive Waste Repositories (SÚRAO).

The basic regulation implementing the Atomic Act in the radiation protection area is Decree No. 184/1997 Coll., on requirements for radiation protection assurance. The regulation specifies details of the manner and extent of the protection of individuals and the environment against adverse effects of ionizing radiation during radiation practices and also during preparation for and actual performance of actions to reduce the existing exposure; as a result, the regulation is used for implementation of most powers established in the Atomic Act in respect to radiation protection.

Among other things, Decree No. 184/1997 Coll. quantifies which materials and objects are considered radionuclide sources (§ 4), i.e. which things and objects are subject to regulation and, on the other hand, which may be excluded from the regulation (§ 5). The decree establishes criteria for ionizing radiation sources classification as insignificant, minor, simple, significant and very significant (§ 6). It also establishes details of the procedures and criteria for radiation protection optimization(§ 7) and introduces exposure limit values (§ 8 - § 13).

Decree No. 184/1997 Coll. also deals with the details of methods and scope of radiation protection provision in the course of radiation practices and in the course of actions to reduce exposure from radiation accidents, specifically:

- establishes the scope and manner of handling the ionizing sources requiring license and requirements for radiation protection provision for the individual types of their handling,
- deals with the details of radioactive waste management, release of radionuclides into the environment,
- establishes technical and organizational conditions of safe operation of ionizing radiation sources and workplaces using such sources, including details about the controlled zone definition and categorization of workplaces with sources of ionizing radiation,
- defines values, parameters and facts necessary from the viewpoint of radiation protection establishes the scope of their monitoring, measuring, evaluation, verification, recording, registration and method of data transmission to SÚJB,
- establishes guideline levels and details on rules for the adoption of measures to prevent or reduce exposure during a radiation accident.

### 10.1.2 Implementation of radiation protection requirements

***Dose limits***

New regulations issued in 1997 made the dose limits values conform to the European Commission Directive 96/29/Euratom.

The most frequently used whole body exposure limits are now expressed as internationally recommended values which express effects of the exposure on the whole human organism (effective dose). They represent a sum of effective doses from external exposure and relevant committed doses from internal exposure in a specified period. New regulations, unlike the previous ones, establish no limits for periods shorter than one year or limits related to periods longer that five consecutive calendar years.

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

The basic effective dose limit for occupational exposure of personnel handling ionizing radiation sources in A and B categories, i.e. persons over 18 years of age, in contact with ionizing radiation consciously and voluntarily and who have been in a demonstrable way instructed about their potential occupational exposure and about the related risks, is 100 mSv for the period of five consecutive calendar years, under the condition that in each calendar year the value shall not exceed 50 mSv. Moreover, a routine regular monitoring is required of personal doses received by personnel in category A, which also includes all persons working in controlled zones of nuclear installations, while the resulting records shall be kept on file for the minimum period of 50 years. To monitor the personnel in categories A and B the Decree No. 184/1997 Coll. also establishes derived limits that are easier to monitor and expressed in more immediately measurable units.

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

Basic general limits for population in the vicinity of a workplace with ionizing radiation sources are related to the average calculated exposure of the most exposed population group, for all expected exposure paths, from ionizing radiation sources and all radiation practices. If no direct data are available for such calculations conservative estimates are used of factors affecting spreading of radionuclides and exposure of individuals in the vicinity of an installation where SÚJB is supposed to establish the dose constraints relating to exposure caused exclusively by this installation and serving as the upper bound to optimize radiation protection of the nearby population.

***Conditions for radioactive discharges***

Discharging of liquid and gaseous radioactive substances from nuclear installations into the environment is regulated by the Atomic Act (§ 9, paragraph 1, letter h)) and more details, including criteria necessary for the corresponding license, are established in § 32 of Decree 184/1997 Coll. The latter establishes that the controlled discharge of radionuclides into the atmosphere or water may be permitted only under the condition that the annual effective dose of the most critical group of population caused by such discharges does not exceed 250 microSievert (μSv). Moreover, this source related upper bound also applies the general limit 1 mSv based on the imission principle which is, however, valid for the annual effective dose from all sources. Each discharge shall be justified and optimized. Therefore the authorized limits of gaseous discharges from individual nuclear power plants would result in annual effective doses lower by an order of magnitude.

A permit to discharge radionuclides into the environment is issued by the SÚJB. Liquid discharges are, however, included into a ”broader” authorization issued by the relevant local water management authority, in agreement with SÚJB in respect to discharged radioactivity. Similarly, authorizations for gaseous discharges are issued by the local office of the Czech Environmental Inspection.

The derived activity limits for discharges are not regulated by any legal document, they are established in the corresponding permits and specifically for each individual installation. NPP Temelín has recently obtained a resolution on the discharges and a corresponding monitoring program has been approved. The resolutions and approved documents for NPP Dukovany have been continually updated.

All discharges are monitored by an extensive monitoring system which includes monitoring by the nuclear installation operators, supervised by SÚJB, as well as independent measurements performed directly by SÚJB or by the Radiation Protection Institute. Results of the measurements provide reliable evidence that the permitted discharges limits are not exceeded and that the calculated effective dose of population due to discharges in the vicinity of the nuclear installations is not higher than tens of micro-Sieverts per year.

***Optimization in radiation protection***

Technical and organizational requirements, limits and procedures used for justification of the reasonably achievable level of radiation protection are established in § 7 of Decree No. 184/1997 Coll. The fulfillment of such requirements is checked within the licensing process and within the course of regular inspections. This means that for nuclear installations:

- feasible alternatives of radiation protection and costs of the corresponding protective measures have to be assessed and compared before commencement of each practice/activity, as well as collective doses and doses in the relevant critical groups, as a rule using the procedure described in paragraph 4 of the mentioned article,
- regular (annual) analysis of doses received during operation in respect to particular activities, while considering additional interventions available to assure radiation protection and comparison with similar operated installations.

The reasonably achievable level of radiation protection can be demonstrated by a procedure which compares costs of alternative protection measures for the enhancement of radiation protection (e.g. introduction of additional barriers) with financial benefits expected from the correspondingly reduced exposure. The reasonably achievable level of radiation protection shall be considered proven and no additional protection measures are required if the costs are higher than the benefits. Decree No. 184/1997 Coll. establishes amounts of monetary equivalents for the reduction of collective effective doses of exposed personnel or population, scaled based on the expected average collective effective dose and exposure limits. The decree also takes into account the possible needed valorization of the financial amounts.

***Radiation monitoring in the vicinity of nuclear installations***

An operator of a nuclear installation is legally responsible for radiation monitoring in the installation vicinity. The monitoring shall be carried out in agreement with a monitoring program approved by SÚJB. The monitoring

program establishes the scope, frequency and methods of measurement and evaluation, as well as the corresponding reference levels. The monitoring at nuclear installations is at present performed, as a rule, directly by specialized departments of the operator. SÚJB inspects fulfillment of the monitoring program and also performs its own independent measurements.

Dose rates in the vicinity of NPP Dukovany and NPP Temelín are continuously monitored by a teledosimetric system operated by the nuclear power plants. There is at least one point of the national independent early warning network close to each plant (see later). Monitoring of the equivalent dose rates due to external exposure in the vicinity of the nuclear power plants is performed by a local network of thermoluminiscent detectors operated by a radiation monitoring laboratory of the respective plant. Independently of these networks, the SÚJB Regional Centers perform their own measurements with thermoluminiscent detectors. Until now, none of these networks has registered any violation of investigation levels caused by operation of the nuclear power plant.

Regular sampling and measurements of radionuclides activity in components of the environment near NPP Dukovany is carried out by a radiation monitoring laboratory and the SÚJB Regional Center in Brno. In the surroundings of NPP Temelín the measurements are performed by a radiation monitoring laboratory and the SÚJB Regional Center in České Budějovice.

Since the nuclear installations are part of the national monitoring network, regulatory bodies receive regular overviews of the measurement results. Moreover, the operator on its own initiative publishes various information materials for the public. This area is governed by the governmental order No. 11/1999 Coll. on the emergency planning zone (see Chapter 2.1.2 of this National Report).

A number of other measurements is performed in the nuclear power plants vicinity with the objective to detect and assess any release of radioactive substances and to provide credible background information necessary to make decisions on measures to protect the population. The measurements are performed within the National Radiation Network coordinated by SÚJB as its central body. Results of the monitoring are submitted to the committee for civil defense and emergency planning and to the public in annual reports on radiation situation on the Czech Republic's territory, through District Authorities, sanitary stations and libraries.

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 while the so-called "emergency" mode focuses on assessment of consequences of such an accident. The regular mode is carried out continuously by so called "permanent elements " of the Radiation Monitoring Network. The emergency mode uses also its "emergency elements". Monitoring in normal conditions is carried out by several subsystems using either some selected or all permanent elements of the Radiation Monitoring Network. The subsystems can be divided into the following five groups:

- ***early detection network,*** composed of 58 continually working measuring points with automatic data transmission of the measured values to the central database. They are controlled by the Czech Hydrometeorology Institute and one point is operated by the State Institute for Radiation Protection and State Institute for Nuclear, Chemical and Biological Protection in Příbram
- ***territorial TLD network*** of 184 measuring points with thermoluminiscent dosimeters. The network is operated by the Regional Centers in co-operation with the State Institute for Radiation Protection,
- ***local TLD networks*** with 78 measuring points equipped with thermoluminiscent detectors in the vicinity of NPP Dukovany and NPP Temelín, operated by these power plants and the Regional Centers in Brno and in České Budějovice,
- ***territorial network for air contamination measurements*** which includes 11 air-contamination measuring points, equipped with large-scale sampling equipment for aerosols and fallout, operated by the State Radiation Protection Institute, SÚJB Regional Centers and radiation monitoring laboratories in the plants vicinity,
- ***network of laboratories*** (6 laboratories of the SÚJB Regional Centers, 3 radiation monitoring laboratories of the State Institute for Radiation Protection and 2 laboratories for environmental monitoring of the plants, equipped with gamma-spectroscopic and radiochemical analyses of the radionuclides content in the environment samples (aerosols, fallouts, food, drinking water, feedstuff, etc.),
- ***mobile groups*** (planes, cars), operated by SÚJB and its Regional Centers, the State Institute for Radiation Protection, Ministry of Defense and NPP Dukovany by and NPP Temelín, equipped with instrumentation measuring dose rates in the atmosphere (volume activity) and on the ground (deposition of radionuclides),
- ***network operated by the Czech Republic Army,*** consisting of 15 permanent measuring points from which 2 are in trial automated operation.

The purpose of the monitoring program performed by the Radiation Monitoring Network is to monitor distribution of radionuclides and ionizing radiation doses on the Czech Republic's territory, in respect to space and time, and especially to establish long-term trends and to detect in time any deviations from such trends. Attention is paid to artificial radionuclides, from which the following occur in measurable quantities and are monitored: $^{137}$Cs, $^{90}$Sr, $^{239+240}$Pu, $^{85}$Kr in the atmosphere; $^{137}$Cs, $^{90}$Sr , 3H in foodstuffs and $^{137}$Cs in human bodies.

Participation in the international exercises has confirmed that the Czech Radiation Monitoring Network is comparable with European standards in respect to its equipment and density of measuring points.

### 10.1.3 Supervisory activities

The Atomic Act entrusted execution pf the state supervision of radiation protection in the Czech Republic to SÚJB. SÚJB is authorized to issue relevant implementing regulations to the said Act, licenses for handling of ionizing radiation sources and for other radiation practices as specified in the Act (see Chapter 3.1.2 of this National Report).

Inspection activities in radiation protection are performed by SÚJB radiation protection inspectors. At present, there are in total 52 inspectors, resided at the Central Office in Prague and at seven Regional Centers all over the country. The inspectors are required to prove professional competence in the field, have a university degree in the respective field and at least 3 year of professional experience. The inspectors are appointed by SÚJB Chairperson (more details in chapter 3. of this National Report).

Three types of inspection are carried out:

- standard (routine) inspections performed by the Regional Centers
- specialized inspections performed by a team of experienced inspectors at nuclear power plants, uranium extraction and processing facilities, radioactive wastes, nuclear medicine, radio therapeutic sources, radio diagnostic sources, major industrial and natural sources
- special inspections "ad hoc" by inspection teams made up of by the most experienced inspectors.

A number of internal procedures has been developed for the inspections and inspection documents to evaluate various types of inspections and now they are used for all the inspection types.

## 10.2 Statement on implementation of the obligations concerning Article 15

The requirements of Article 15 of the Convention are fulfilled in the Czech Republic, both in respect to legislation and implementation.

# 11. Emergency preparedness - Article 16 Of the Convention

(*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 in neighboring country, shall take 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.*

## 11.1 Description of the current situation

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

The legislative framework for the emergency preparedness of nuclear installations and their surroundings is in particular given by the Act No. 18/1997 Coll., on Peaceful Utilization of Nuclear Energy and Ionizing Radiation (the Atomic Act), its implementing regulations and related government ordinances (see chapter 2.1.2 of the present National Report).

§ 2 of the Atomic Act defines the basic terms - emergency preparedness, radiation emergency, radiation accident and emergency plans (on-site, off-site).

In accordance with Article 3, within its competence, the SÚJB:

- Approves on-site emergency plans and their modifications, subject to discussion with the relevant District Authority of their compatibility with off-site emergency plans; the approval of on-site emergency plan is one of the conditions for obtaining permit for the installation commissioning and operation,
- Establishes emergency planning zone - upon the licensee proposal,
- Co-ordinates the activity of the National Monitoring Network and works as its head office,
- Ensures the activities of the Emergency Coordination Center and international information exchange on radiation situation,
- Ensures by means of the National Radiation Monitoring Network and based on assessment of the radiation situation the background information necessary to decide on the measures aimed at reducing or averting exposure in the event 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 trade secret, and publish once a year a report on its activities and submit it to the Government of the Czech Republic and to the public.

In its Article 4 the Atomic Act establishes the principles for averting or reducing exposure due to radiation accidents and exposure of people who participate in the mitigating interventions. These principles are elaborated in the Implementing Decree No. 184/1997 Coll., on Requirements for Radiation Protection Assurance.

Article 17 of the Atomic Act establishes within the general obligations, 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 impacting on emergency preparedness, including changes in any facts relevant for license issuing.
Article 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 with an impact on emergency preparedness, to the extent laid down in implementing regulations,
- Keep and archive records of ionizing radiation sources, facilities, materials, activities, values, parameters and other facts important for emergency preparedness, and submit the recorded information to the SÚJB in the manner set out in an implementing regulation,
- Ensure systematic supervision of emergency preparedness observance, including its verification.

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

- Notify without delay the relevant District Authority, the SÚJB and other relevant bodies specified in the on-site emergency plan, of the occurrence or suspected occurrence of a radiation emergency,
- To warn the public within the emergency planning zone in case of the event of a radiation emergency,
- Ensure that the consequences of the radiation accident are dealt within premises, where his activities are performed and to take measures to protect employees and other persons from the effects of ionizing radiation,
- Ensure 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 about monitoring results, of factual and anticipated development of the situation, of interventions taken to protect employees and the public, and measures taken to deal with the radiation accident and also of factual and anticipated exposure of people,
- Control and regulate exposure of employees and other persons participating in the radiation accident mitigation within the premises where the licensee performs his activities,
- Co-operate in dealing with consequences of the radiation accident which occurred on his premises,
- To participate, in case of radiation emergency, in activities of the National Radiation Monitoring Network.

The same Article also establishes the obligation of the licensee to submit to the appropriate District Authority background documents to prepare the off-site emergency plan and to co-operate with it to ensure emergency preparedness within the Emergency planning zone. It also establishes, that a government ordinance concerning the emergency planning zone will set out his financial share in covering activities of the National Radiation Monitoring Network, in providing the public within the emergency planning in relevant installations or workplaces with antidotes, running a press and information campaign aimed at ensuring that the public is prepared for radiation emergencies, in providing a system for notification of relevant bodies, as well as his obligation to participate in radiation accident clean-up operations within the emergency planning zone.

In relation with the issuance of the Atomic Act No. 18/1997 Coll., some other acts were altered and amended and tasks and obligations of some central bodies of the State administration concerning emergency preparedness were defined. In the first plan the Act No. 425/1990 Coll., on District Authorities was amended:

- Requirement to draw up an off-site emergency plan for dealing with extraordinary events, radiation emergencies, and to verify emergency preparedness as defined in the off-site emergency plan,
- Requirement to co-ordinate the preparation of an off-site emergency plan for the emergency planning zone in the event of an accident that could affect more than one district, the chairman of the District Authority on whose territory the nuclear installation is sited, shall ensure co-ordination of the joint effort in dealing with the emergency.

Further the atomic Act authorized the Ministry of Interior to issue a new Decree no. 25/2000 Coll. establishing details for preparation of district emergency plan and off-site emergency plan.

Last but not least following tasks and obligations were established for:

- Ministry of Defense, providing for the emergency preparedness and its verification, in accordance with the Article 46 of the Atomic Act, its annunciation and warning monitoring system, means of collective and individual protection of the public, and also forces and means for elimination of radiation accident consequences (the above tasks are, based on the Act no. 239/2000 Coll., took over by the Ministry of Interior starting with 2001, whilst both departments are intensively working on the form of contractual assurance of the special forces and means of the Czech Army to the benefit of the emergency situation solution),
- Ministry of Interior, to arrange and verify emergency preparedness and monitoring system and notification and warning system, to provide means of collective and individual protection of the public, and also forces and means for dealing with the consequences of a radiation accident,
- Ministry of Health to create a system of special medical care provided by selected clinics to persons irradiated during radiation accidents.

Details and requirements for emergency preparedness in the event of an extraordinary situation (radiation emergencies and accidents) are established in the implementing regulations related to the Atomic Act:

- **SÚJB Decree No. 219/1997 Coll.,** on Details in Emergency Preparedness of Nuclear Facilities and Workplaces with Ionizing Radiation Sources, and on Requirements on the Content of On-Site Emergency Plans and Emergency Rules,
- **SÚJB Decree No. 184/1997 Coll.,** on Radiation Protection Assurance Requirements.

SÚJB Decree No. 219/1997 Coll., establishes details of assuring emergency preparedness of nuclear installations, such as:

- Detection of extraordinary event occurrence,
- Assessment of the extraordinary events significance and their classification in three basic degrees,
- Announcing an extraordinary event,
- Activation of persons participating in the intervention,
- Control and performance of the intervention,
- Requirements for the intervention procedures and instructions,
- Requirements for the radiation situation monitoring program,
- Methods to reduce exposure of the personnel and other persons,
- Medical care principles,
- Ensuring documenting of the activities during an extraordinary event,
- Submitting information on the occurrence and development of an extraordinary situation to the SÚJB,
- Requirements for training of personnel and other persons,
- Requirements for the emergency preparedness verification, including emergency exercises and functionality checks of technical means and devices required for control and performance of the intervention,
- Requirements for the contents of an on-site emergency plan,
- Requirements for other documentation related to emergency preparedness.

Decree No. 184/1997 Coll., in the provisions of Articles 64 through 66 and in Appendix 8, establishes details in the manner and scope of radiation protection assurance during interventions to reduce exposures due to radiation emergencies. It also establishes reference values for the immediate and follow-up protective interventions.

**Governmental Order No. 11/1999 Coll.** established for the license holder following requirements:

- For the elaboration of a proposal for establishing an emergency planning zone for the nuclear facility or workplace with an significant source of ionizing radiation (the license holder submits this proposal to SÚJB for the determination of the emergency planning zone size in accordance with the Article 17 of the Atomic Act),
- For ensuring the activity of National Monitoring Network in the emergency planning zone,
- For the provision of the emergency planning zone population with antidotes,
- For the assurance of press and information campaign for the population in the emergency planning zone for the cases of radiation emergency,
- For the notification system of involved bodies about occurrence or suspect radiation emergency notification,
- For the population warning system in the emergency planning zone assurance.

Further requirements are given by the acts, adopted in 2000, i.e. by the Act No. 239/2000 Coll., on the integrated rescue system, and by the Act No. 240/2000 Coll., on crisis management (Crisis Act).

**Act No. 239/2000 Coll.** replaces, among others, also the original provisions of the Article 43 of the Atomic Act in the issue of the District offices field of competence during activities planning, and solution of radiation emergencies, of the population and environment protection within the emergency planning zone and the districts (Note: cancelled by the Act No. 132/2000 Coll., on the change and cancellation of some Acts related with the Act on the regions, Act on the communes, Act on the district office and Act on the Capital City Praha). Further the Act defines in particular:

- Basic and other components of the integrated rescue system, their fields of activity and competences of state bodies and bodies of the self-governing administrative territories, rights and duties of legal and physical persons during the preparation for extraordinary events and during rescue and liquidation works, and during the population protection during crisis conditions including the radiation emergencies,
- Basic requirements for regions and districts when processing off-site emergency plans for the performance of rescue and liquidation works for the emergency planning zones, which are part of territorial crisis management plans, and which are elaborated in accordance with the Act No. 240/2000 Coll.,
- Tasks of the crisis management bodies and representatives of regions, districts, communes, legal and physical entities during the management of crisis situations on the territory, affected by the extraordinary event
- Conditions of the rescue and liquidation works in the intervention point,
- The Act has further changed the activity range of the Ministry of Interior, to which it assigned the execution of state management in the area of the protection of the population instead of the Ministry of Defense.

**Act No. 240/2000 Coll.** establishes the range of activity and competence of state bodies and bodies of the self-governing administrative territories, and rights and duties of legal and physical entities during the preparation for extraordinary events and during their resolution. It establishes bodies of crisis management and solves the issues and tasks to be solved by safety comities during the crisis preparedness assurance for the cases of extraordinary events occurrence and of the crisis staffs in case of their occurrence. It establishes requirements for the elaboration of crisis plans of the central state administration bodies, territorial state administration bodies and municipalities, and in case of crisis conditions declaration. The Act further establishes rights and duties of legal and physical entities during the preparation for crisis situations and during their resolution.

Based on delegation in accordance with the Act No. 240/2000 Coll. among others also the Governmental order No. 462/2000 Coll. was issued, for the application of the Article 27 paragraph 8 and Article 28 paragraph 5 of the Act No. 240/2000 Coll. This Governmental order establishes in particular requirements for the handling of crisis management documents, which could be misused, as handling of special facts and belongings, and way of elaboration of crisis plans of the central state administration bodies, territorial state administration bodies, and municipalities (regions, districts, and communes), and plans of the crisis preparedness of legal entities or small businesses of physical persons for securing the availability, preparedness to the fulfillment of crisis measures and protection against crisis events effects.

**Ministry of Interior Decree No. 25/2000 Coll.,** establishes details for the elaboration of district emergency plan and off-site emergency plan for the determined emergency planning zone of a nuclear facility or workplace with a very significant source of ionizing radiation. Off-site emergency plan is broke-down in:

- Information section,
- Operations section,
- Plans of specific activities.

Information section includes:
- Description of the emergency planning zone territory characteristics, including data on demography, geography, climatic conditions and infrastructure,
- Analyses results of possible radiation emergencies, and possible radiological effects on the population and environment,
- Classification system of extraordinary events in accordance with the on-site emergency plan,
- Requirements for the population and environment protection in relation to intervention levels during the radiation accident,
- Description of the emergency preparedness organizational structure in the emergency planning zone,
- Description of the annunciation and warning system, including the links to the license holder and information transfer within the emergency preparedness organization in the emergency planning zone.

Operations section includes:
- Overview of the prepared measures, to be performed by the license holder after the notification of a suspect radiation accident occurrence or occurrence of such event,
- Overview of the tasks of the corresponding administration offices and components of the integrated rescue system,
- Way of radiation accident resolution coordination,
- Way of securing information flows during the radiation accident consequences liquidation management,
- Ways, procedures, and forms of providing information for the population in the emergency planning zone including their contents, such as:

a) About the character of the possible jeopardy and about measures, to be taken for the protection of the population,
b) About the real jeopardy and about adopted measures for the protection of the population in case of radiation accident occurrence.

Plans for particular activities establish procedures for the implementation of the individual measures for the following areas:
- Notification,
- Population warning,
- Integrated rescue system units interventions,
- Sheltering the population,
- Iodine prophylaxis,
- Evacuation of persons,
- Individual protection of persons,

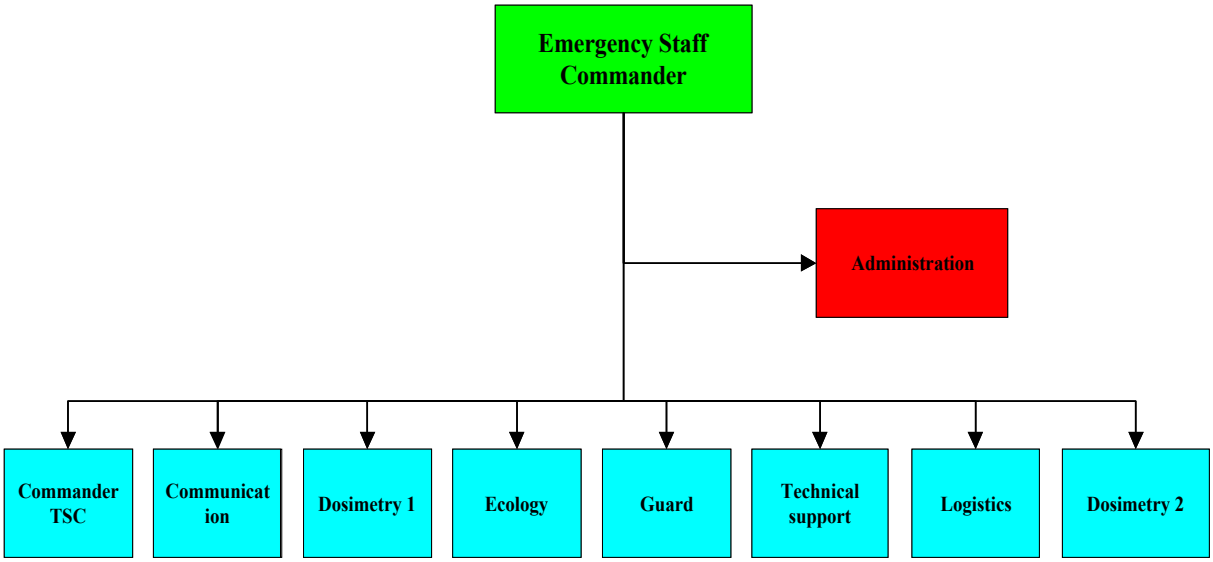
- Decontamination,
- Monitoring,
- Regulation of persons movement and transport,
- Health care,
- Cattle protection measures,
- Food, pasturage, and water, contaminated by radionuclids distribution and consumption control,
- Measures in case of death of persons in the contaminated area,
- Public order and safety assurance.

### 11.1.2 Implementation of emergency preparedness tools, role of the State Regulatory Body and other relevant bodies

***Dukovany NPP shift emergency staff***

For the management of activities and works related to the liquidation of occurred extraordinary events and their consequences a shift emergency staff is nominated by the director, to have continuous emergency. The shift emergency staff is established as the top control body within the internal emergency organization, providing for the fulfillment of preventive and repressive tasks related with the protection of persons and property in case of radiation emergency. For the reason of prompt availability for action during the emergency organization management, and for the case of long term emergency situations of the degree 2 and 3, the staff works in four shift continuous cycle and its task is to control activities and works related to the liquidation of emergency events and their consequences. During the duration of the emergency event and liquidation of its consequences, the shift emergency staff is the main control unit, taking over the responsibility for the resolution of emergency situations after its activation. It issues recommendations for the shift engineer and the main control rooms personnel based on available data, its experience and software tools enabling the prognosis of the emergency situation prognosis.

Emergency shift of the emergency staff is composed of 10 members in the following functions:




Commander of the shift emergency staff coordinates the activities of other subordinated functions or units, controls their activities, approves the decisions of the shift emergency staff and approves all reports, released for all other internal units of the emergency organization, for off-site units of the emergency organization and outside of them. It transfers tasks to the subordinated functions, the fulfillment of which is required for the liquidation of extraordinary events and their consequences.

The workplace of the shift emergency staff is prepared for continuous emergency in the shelter below the administrative building, and is equipped with equipment securing the protection of personnel against the effects of radioactive irradiation, and with hardware necessary for carrying out activities, related with the performance of tasks of the shift emergency staff. Further it serves to support the solution of emergency conditions, severe accidents. The workers in this center provide consulting for the MCR operators, cooperate with the safety engineer and shift engineer.

***NPP Temelín emergency response organization.***

In accordance with the secured activities, dislocation of individual emergency support centers, or the time durations of their activations after the announcement of an extraordinary event, the emergency response organization is divided into two basic components:

Internal organization of emergency response (IOHO) represented by the continuous shift operation personnel, i.e.:

- Operational MCR personnel
- Shift personnel assigned to act as member of the shelter groups
- Other shift personnel, assigned for the performance of interventions (members of the HZSp and other shift personnel assembled in the operational support center, which could be used for operative interventions).

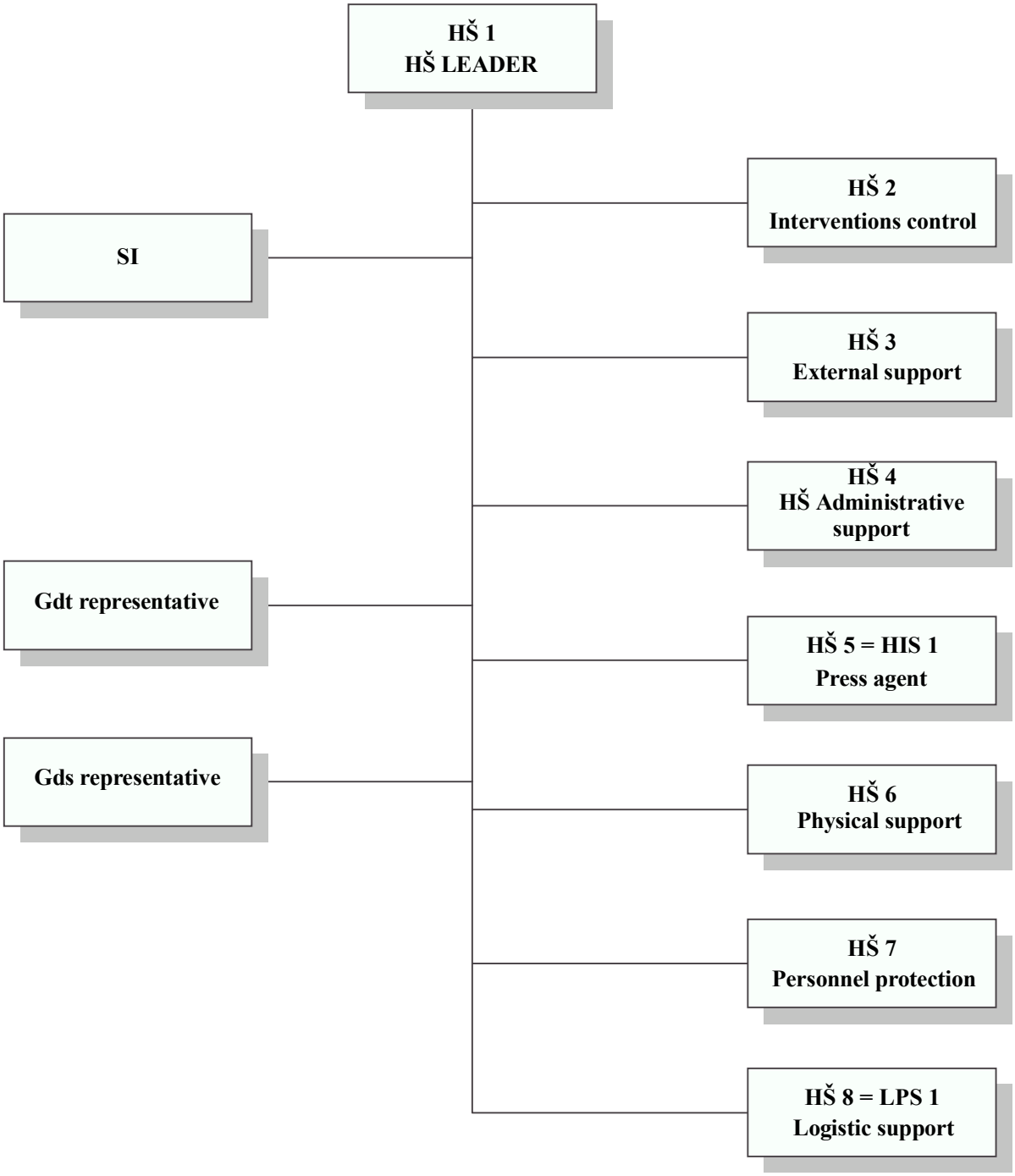
Accident response emergency organization (POHO) formed by personnel of the emergency support centers, keeping weekly continuous readiness, i.e. by the following personnel:

- Technical support center
- Emergency staff
- Off-site emergency support center
- Emergency information center
- Logistic support center

Main tasks of the Emergency staff as a control body is the to control all activities in the plant, to transfer information to superior and regulatory bodies, and to inform the public (through the emergency support center) and announcing of protective measures for ČEZ-ETE personnel and further persons, present on the Temelín NPP site. It controls the activities of the operatively established intervention groups. It secures the deliveries of

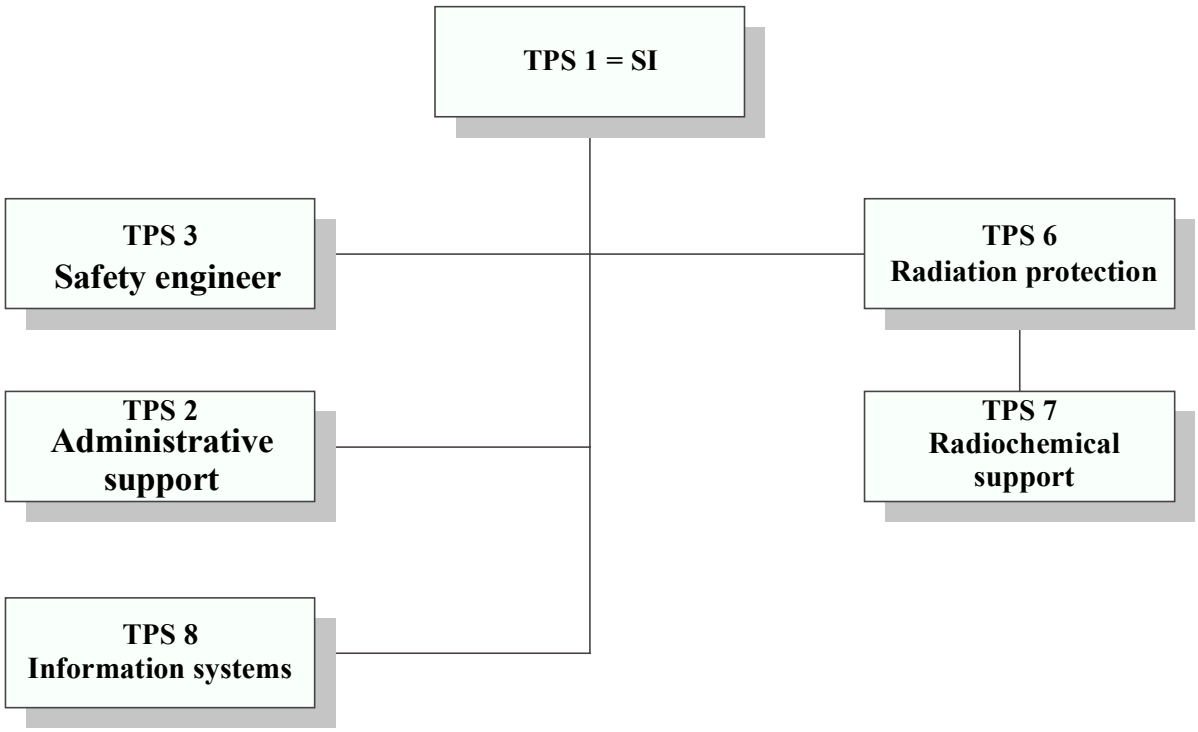
necessary materials, special means, alternating the personnel and their maintenance and supplies through the logistic support center.

Temelín NPP emergency staff (HŠ) organization structure is shown in the figure below:



The professional composition of the Technical support center (TPS) is made in the way to enable the provision of qualified technical support to the control room personnel of the affected unit in the resolution of extraordinary events. The TPS personnel ensure simultaneously immediate evaluation of the safety condition of the NPP with respect to nuclear safety and radiation protection. Its is able to process background data and recommendations for decision-making and control activities of the emergency staff.

Technical support center organization structure is shown in the figure below:

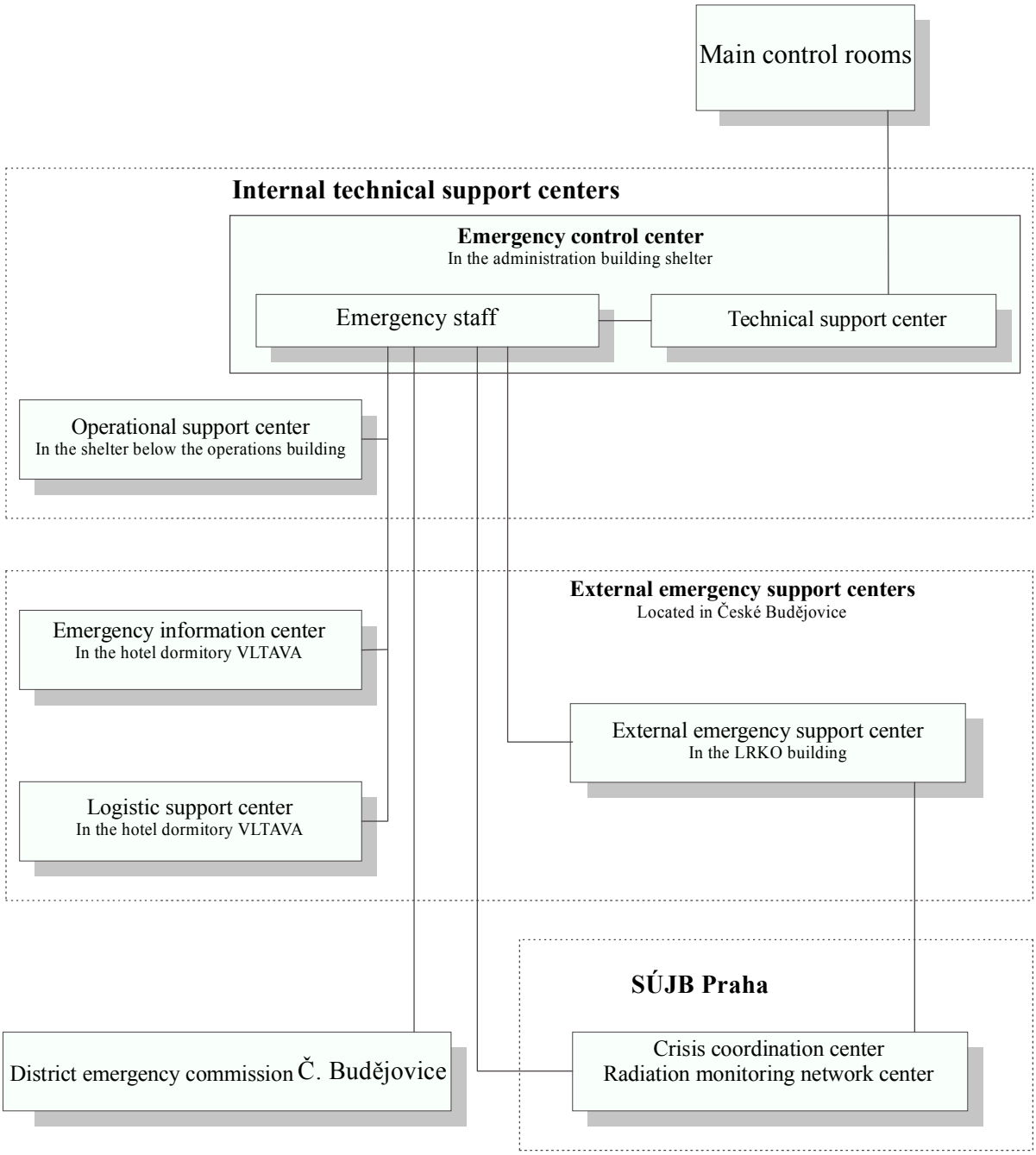



Off-site emergency support center provides for activities, related to radiation monitoring and to the assessment of the radiation situation in the emergency planning zone of the Temelín NPP. Based on the radiation monitoring results it processes prognoses of the further radiation situation development during the first phase of the radiation accident.

In the emergency preparedness system the emergency support centers represent a specially prepared and equipped workplaces designed to secure the support of plant personnel activities, involved in the on-site or off-site emergency response organization. The emergency response organization is composed both of the nuclear power plant personnel and persons from external organizations such as state administration and regulatory

bodies. From the external links viewpoint these NPP emergency support centers are linked to Crisis coordination center and the Radiation monitoring network headquarters in SÚJB and to the state administration bodies.

The schematic diagram of the NPP Temelín technical support centers is shown in the following figure:




Technical support center, Emergency staff and Off-site emergency support center are equipped with up to date computer based information systems, enabling to access all technological parameters and warning messages, which are normally available in the Main control room and in the room of the shift engineer. The systems enable real-time access to all parameters and their trends, which could be used for the solution of emergency events independently in each center. This provides for a fast and effective access to information for the persons taking decisions and persons performing analyses without direct personal contact with the main control room personnel. This eliminates the possibility of errors, typical for other methods, relying on manual data transcription and transfer. Possibility to access this information in real time in more locations enables in case of necessity free movement of the main decision making persons.

All equipment has sufficient space capacity and accessories to enable effective activities and continuous monitoring of the situation. Emergency support centers of the Temelín NPP use the existing shelters (including

the emergency control center), providing for shielding, and having backup electric power supply, independent ventilation systems, enabling intake and extraction of air in the mode of partial filtering, or sufficient air quality in the recirculation mode (i.e. it provides for the air enrichment with oxygen). Shelters for the protection of plant personnel have sufficient capacity for all employees and persons present in the plant premises. The check of the number of persons in the shelter is facilitated by using a technical system of physical protection having the necessary backup.

Emergency support centers are equipped with communication means having their own backup systems and reserve power supply sources. Health center located on site is equipped for treatment and decontamination of injured or contaminated persons. Professional workers of fire protection and emergency services are available 24 hours per day.

***Classification of emergency situations***

To assess significance of extraordinary events (operational occurrences), which may occur during operation of a nuclear installation, these events are classified in three basic degrees (§ 5 of the SÚJB Decree No. 219/1997 Coll.):

- *1st degree - extraordinary event* which leads to or may lead to an inadmissible exposure of the personnel and other persons or inadmissible release of radioactive substances into the environment; 1st degree event can be a radiation emergency, it has a limited local character, forces and means represented by operators or work shift are sufficient to deal with it,
- *2nd degree - extraordinary event* which leads to or may lead to an inadmissible significant exposure of the personnel and other persons or inadmissible release of radioactive substances into the environment; event of 2nd degree is a radiation emergency, to control this situation requires activation of the intervening personnel of the licensee and it can be dealt with by forces and means of the licensee or forces and means contracted by the licensee,
- *3rd degree - extraordinary event* which leads to or may lead to an inadmissible significant release of radioactive substances into the environment which requires implementation of urgent measures for protection of the public and the environment, specified in the off-site emergency plan; 3rd degree event is a radiation accident and control of this situation requires (besides the activation of intervening personnel of the licensee and intervening persons according to the off-site emergency plan) involvement of other relevant bodies.

***National emergency preparedness and response systems***

In accordance with the newly adopted legal regulations, in particular in the area of emergency management, a structure of the emergency preparedness was established for the case of emergency events of different type. Fig. 11-1 shows the basic diagram of the structure of the Czech emergency preparedness system for the event of a radiation accident.

In case of radiation emergency occurrence in the inland or abroad with a possible impact on the Czech republic territory, the emergency situation is being solved within the emergency response system, the basic diagram of which is given in the Figure 11-2.

Figure No. 11-1

**Basic diagram of the Czech republic emergency planning structure for the case of radiation emergency occurrence**

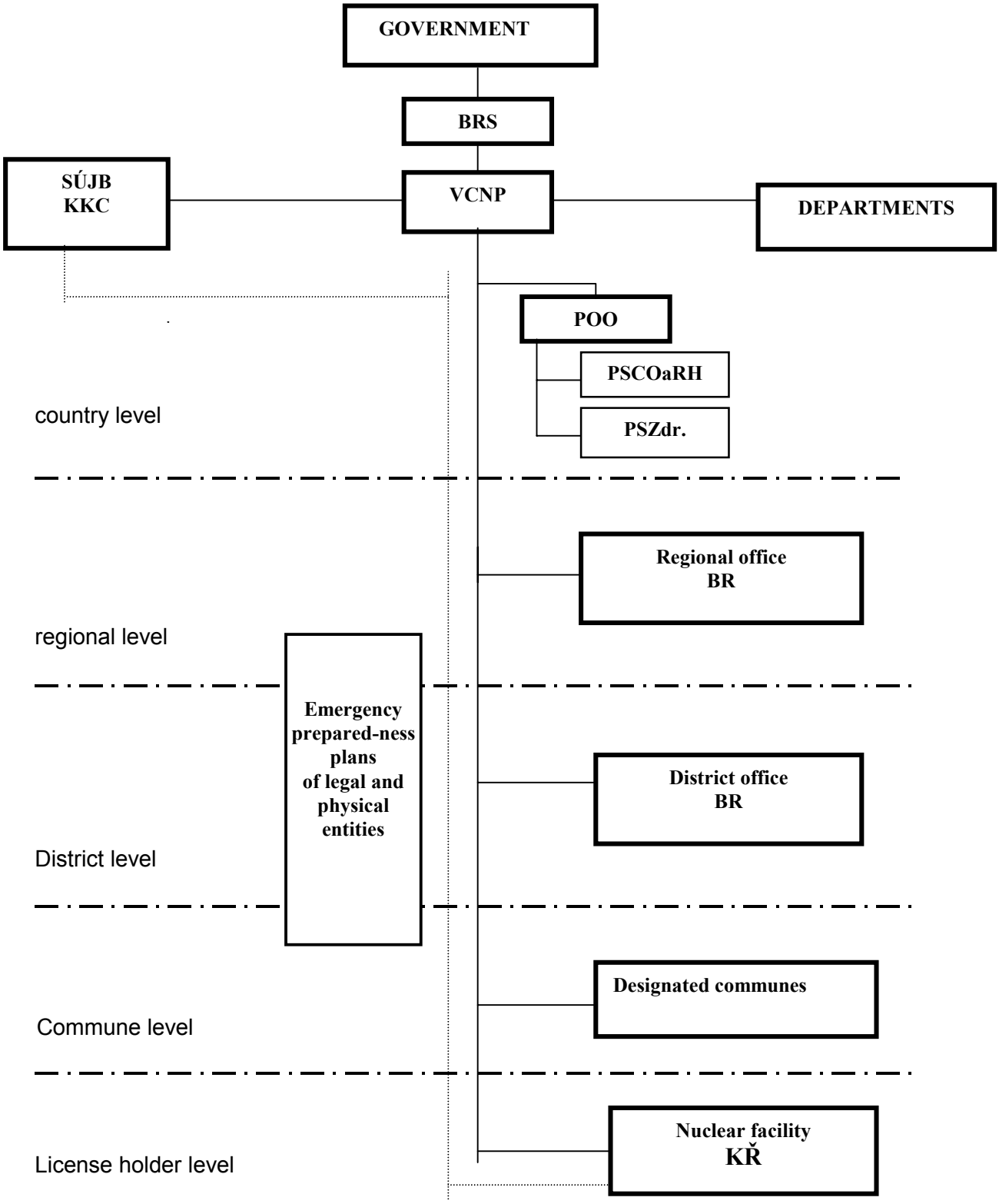
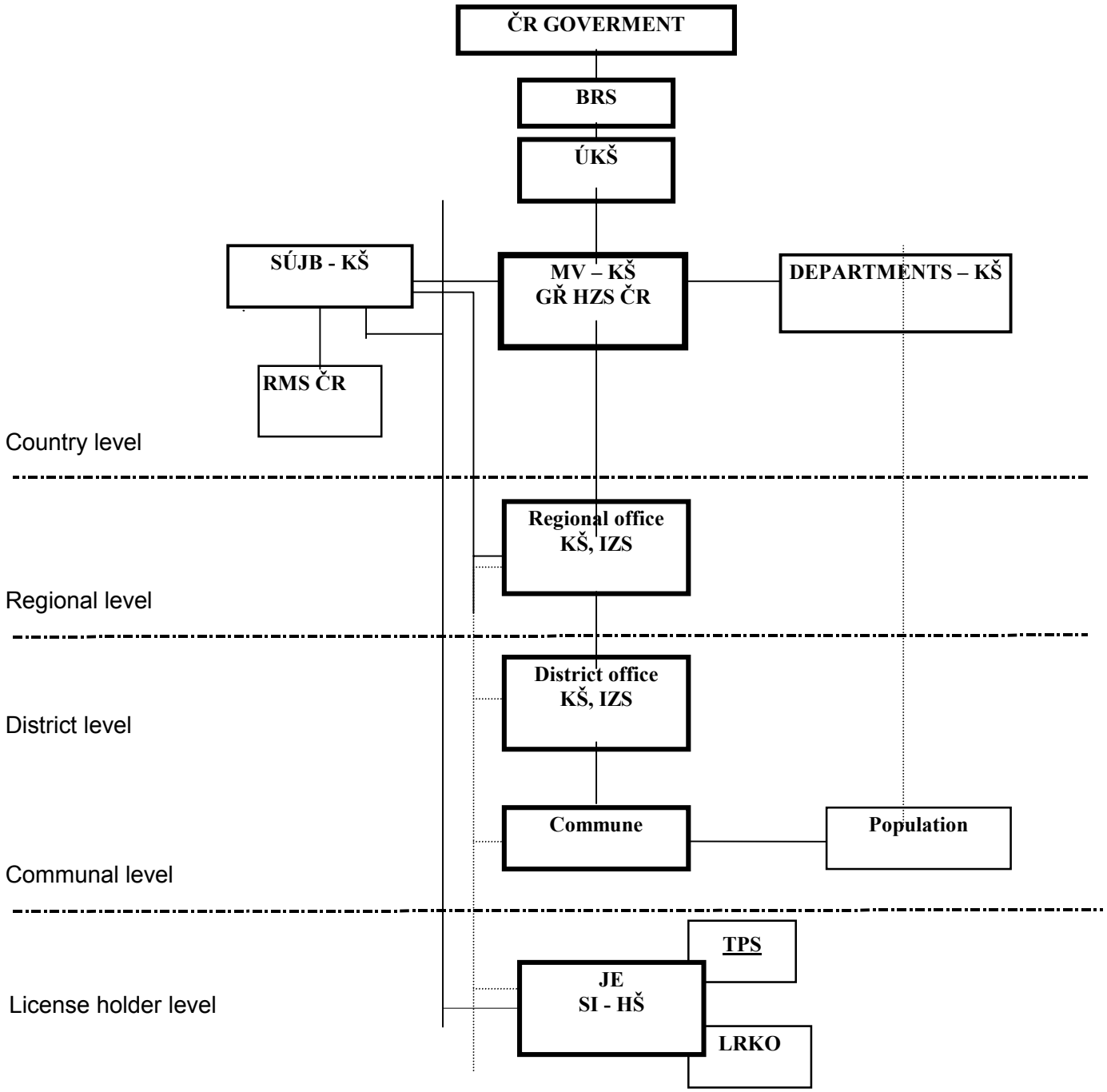


Figure No. 11-2

**Basic diagram of the Emergency response structure in ČR during the radiation emergency occurrence**



It results from the above that the Czech Republic government is the highest body, responsible for the emergency situations preparedness and in case of their occurrence for their solution in the territory of the country. In the Constitutive Act No. 110/1998 Coll., on the Czech Republic security, the State Safety Committee (BRS) was established. In consequence of this Act, the government established by intermediary of its Decision No. 391 from the year 1998 the composition of the BRS, and specified its main tasks in the area of emergency preparedness and emergency situations solution. Simultaneously with this decision it has established a Committee for civil emergency planning (VCNP) as a permanent BRS working body for the coordination of the planning of measures to secure the protection of internal safety of the country, protection of the population and protection of the economy, and to coordinate the requirements for civil resources necessary for further security of the Czech Republic. In 1999 the government dissolved, by its Decision No. 1359 the Governmental commission for radiation emergencies (VKRH), and transferred its tasks in the area of planning and preparedness for the case of radiation emergency occurrence to the competences of VCNP and the areas of emergency solution to the competence of the Interdepartmental emergency staff, which was established by the Decision No. 33 dated 11$^{th}$ January 1999, and acts as a BRS working body for the resolution of emergency occurrences. In consequence to the Act No. 240/2000 Coll., the Emergency act, the name of the Interdepartmental emergency staff changed to Central emergency staff (ÚKŠ) by the governmental decision No. 53, dated 10$^{th}$ January 2001.

Main tasks in the area of planning and preparedness to emergency situations, including radiation emergencies, are specified in the VCNP rulings. In the area of the protection of internal state safety protection, population protection and economy protection, they are directed in particular to:

- Interdepartmental coordination of planning and preparative activities,
- Assessment and discussion of planning and preparatory activities, presented by the central bodies of the state administration.

The chairman of VCNP is the Minister of Interior and the members of this committee are vice ministers and the SÚJB president.

Through a resolution of VCNP in 1998 a Subcommittee for the population protection (POO) was established, securing in particular the coordination of:

- Material problems and measures for securing the support of the population, protection of health and life of persons, property, and environment protection,
- Activity of rescue units and emergency services during extraordinary events and receipt and provision of humanitarian help,
- Fulfillment of civil protection tasks.

Members of this subcommittee are the representatives of ministries from the crisis management departments, including SÚJB and the head of this subcommittee is the representative of the Ministry of Interior - Headquarters of the fire protection rescue corps of the ČR. For securing the POO professional activities, two permanent professional working groups are established for the following areas:

- Civil protection and radiation emergencies,
- Health care.

Members of these groups are experts in the corresponding areas of population and environment protection during occurrences of extraordinary events (industrial accidents, natural calamities, etc.).

For securing the solution of emerged emergency situations including the radiation accidents on national level a working body of BRS, the ÚKŠ is established. The chairman of the ÚKŠ is the Minister of Interior. The members of ÚKŠ are vice ministers and managers of other bodies of state administration including the SÚJB president.

ÚKŠ is also activated both in case of radiation emergencies of a nuclear facility outside the Czech republic territory with the possibility of impact on the Czech Republic, and during radiation emergencies occurring during the transport of radioactive substances.

***On-site and off-site emergency plans of nuclear installations including supporting bodies and systems***

On-site emergency plans of nuclear installations (licensees) are prepared in compliance with requirements for emergency preparedness assurance, and in the extent established by Decree No. 219/1997 Coll. These requirements:

- Establish the organizational structure of the licensee and principles for control and mitigating interventions in the event of emergency occurrence. In this connection, they define duties of persons and on-site organizational departments and units in an emergency, classified in accordance with their significance as

extraordinary events (refer to Classification of emergency situations),

- Establish the method 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 premises (licensee),
- Establish methods of notification of the SÚJB and other State administration bodies (District Authorities to the territory of which extents the emergency planning zone) on the occurrence of an extraordinary event of 1st and 2nd degree, and in the event of an extraordinary event of 3rd degree - radiation accident - the methods of their notification and warning the public within the emergency planning zone.

On-site emergency plans (VHP) specify the requirements for the radiation situation monitoring program during extraordinary events for the nuclear installation premises (licensee) and for its neighborhood. The plans establish methods of notification and warning of the personnel and persons present in the nuclear facility (licensee) for the individual degrees of extraordinary events, and necessary measures are specified there for the protection of their health and life, and for the limitation and reduction of their irradiation. These plans define principles and procedures of assembling, sheltering, evacuation, providing emergency first medical aid to all employees and persons affected, including medical care and specialized medical care.

The on-site emergency plan establishes principles and procedures for documenting all activities from the moment of the emergency occurrence and during it, as well as methods and procedures for the notification of bodies and organizations, affected by VHP, are processed in form of intervention instructions. The latter ones specify in detail activities after the annunciation of the corresponding degree of emergency event including the necessary technical, instrumental, and material assurance.

***Dukovany NPP***

The current off-site emergency plan for the NPP Dukovany emergency planning zone was approved in accordance with the requirements of the new legal regulations, in particular the Act No. 239/2000 Coll and the Ministry of Interior Decree No. 25/2000 Coll. under coordination with the regional authorities in cooperation with the regional authorities of the South Moravian region and district authorities of the Třebíč, Znojmo and Brno-country departments. The reworked off-site emergency plan is being assessed by the Ministry of Interior - Headquarters of the fire protection rescue corps of the ČR in cooperation with SÚJB.

They set down the targets and methods of ensuring the individual types of protective measures:

- Notification of authorities and organizations,
- Warning of the public,
- Sheltering people,
- Evacuation of people, including dosimetric monitoring and decontamination at the exits from the contaminated territory,
- Regulation of people movements within the endangered territory,
- Health care.

***Temelín NPP***

The off-site emergency plan for the NPP Temelín was elaborated in accordance with the Ministry of Interior Decree No. 25/2000 Coll. for the specified emergency planning zone (by decision of SÚJB No. 311/1997) under coordination with the District authorities of the České Budějovice district in cooperation with other district authorities, the territory of which extend to the emergency planning zone (Písek, Prachatice, Strakonice, Tábor). The off-site emergency plan was approved, after a verification by an exercise, by the České Budějovice District office head prior the fuel loading.

The off-site emergency plan for the NPP Temelín emergency planning is reworked in accordance with the requirements of the new legal regulations, in particular the Act No. 239/2000 Coll. under coordination with the regional authorities in České Budějovice in cooperation with the regional authorities České Budějovice, Písek, Strakonice, Tábor, and Prachatice. The reworking of the off-site emergency plan is being assessed by the Ministry of Interior -Headquarters of the fire protection rescue corps of the ČR in cooperation with SÚJB.

After the District Authorities have been notified, the most important measure for the protection of the public is a warning issued in the emergency planning zone, which is, according to the on-site emergency plan, ensured by both nuclear power plants. Warning of the public is assured within the whole emergency planning zone, formed by a territory 20 km around NPP Dukovany and 13 km around Temelín NPP. The public is warned by a signal of sirens with following broadcasting of the prepared initial information on the radiation accident which occurred at the nuclear power plant, and on the measures to be carried out by the public (sheltering, iodine prophylaxis - taking KI preparate) and recommendation on the preparation for evacuation of people within 5 km zone around nuclear power plant Dukovany and in 5 out of 16 sectors up to 10 km in accordance with the wind direction. For

Temelín NPP the preparation for evacuation is ensured in the 5 km internal emergency planning zone including the communes on its boundary. Iodine prophylaxis (KI preparate) is distributed in advance to the population within the emergency planning zone (families, schools, hospitals, workplaces; the District Authorities have approximately 10 % reserve of KI doses, and these preparations are on sale in pharmacies). Preparates of potassium iodide held by the public are regularly exchanged by the District Authorities before their expiration deadline. The off-site emergency plans also establish tasks of regulating movement of the public within the endangered territory, manner and performance of the evacuation, which is carried out upon decisions of the heads of District Authorities in accordance with the SÚJB information. Check points at the exits from affected territory within the emergency planning zone are also established where a dosimetric monitoring of persons and means of transport are planned and carried out, including their decontamination. Off-site emergency plans establish principles and methods of health care for the public affected by the radiation accident.

Schematic representation of the annunciation system in case of emergency situation occurrence is given in the Figure No. 11-3 and a schematic representations of the Public warning system in ZHP is given in the Figure 11-4.

Figure 11-3

**Schematic presentation of the annunciation system in case of radiation accident occurrence**

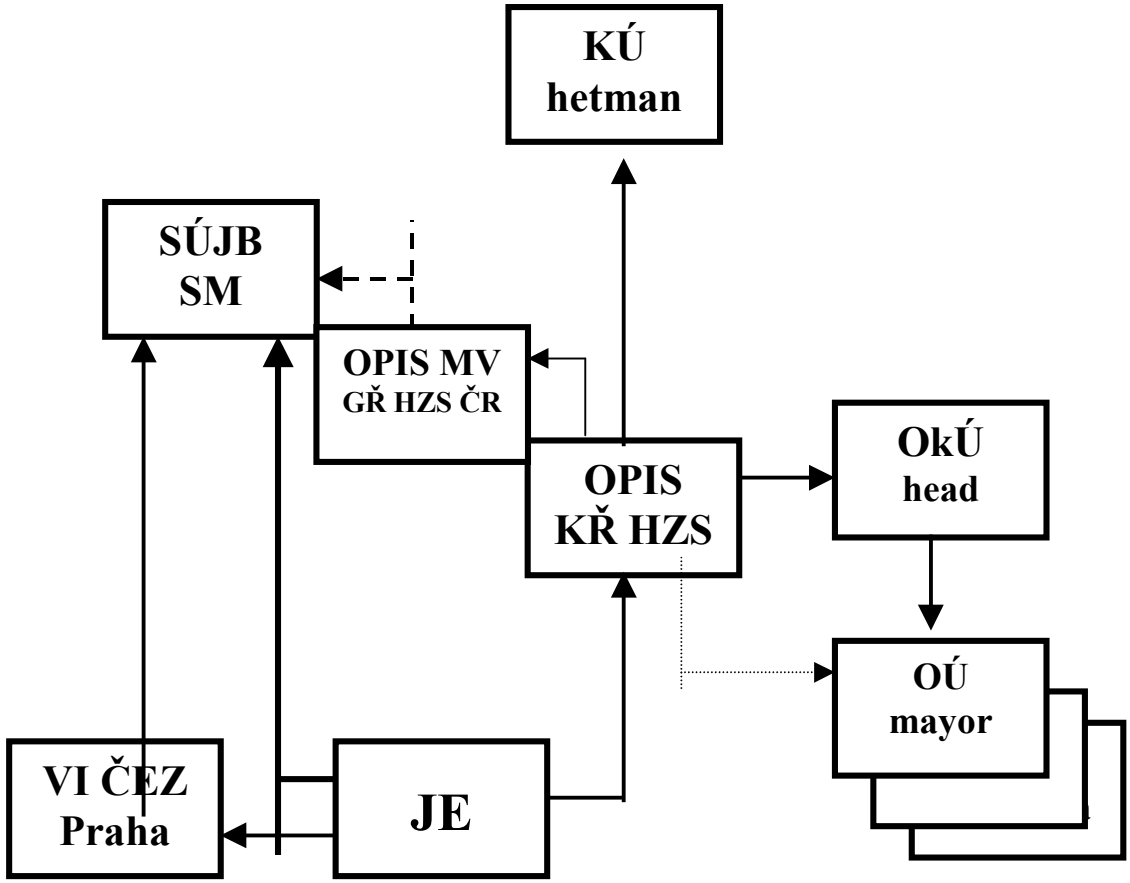
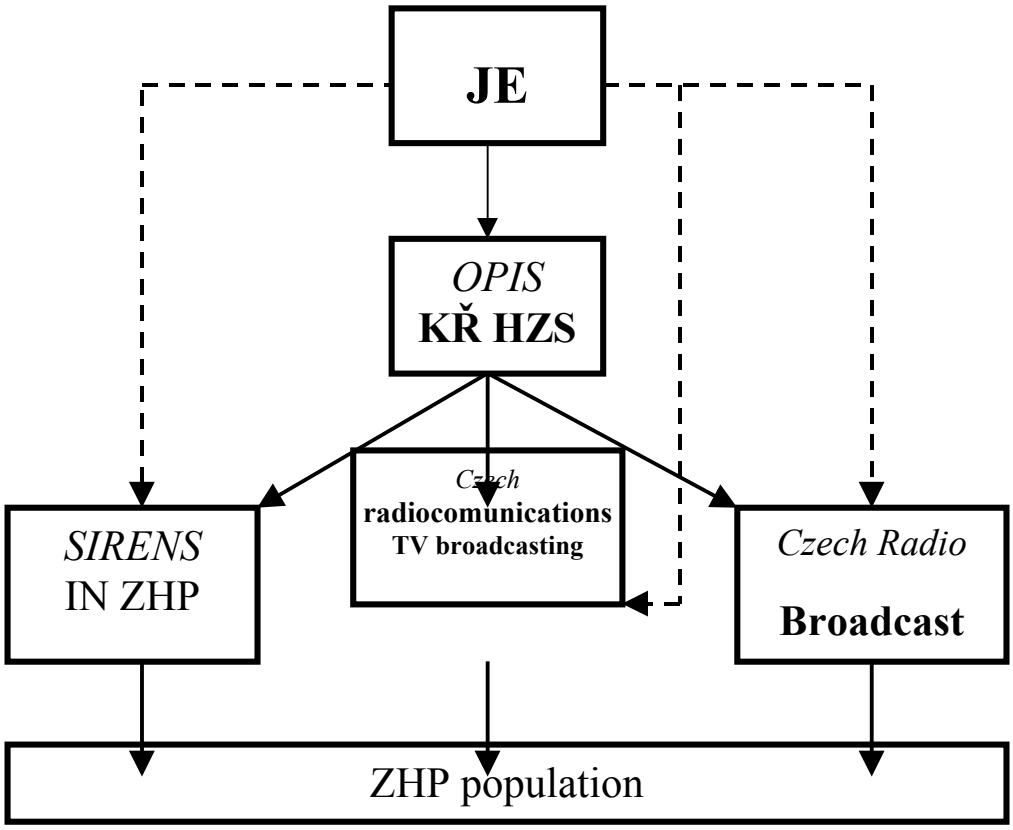


Figure 11-4

**Schematic presentation of the public warning system in the emergency planning zone (ZHP)**




The full lines mark the basic warning system; dashed line marks the backup system.

In accordance with the Article 3 of the Atomic Act, SÚJB provides, based on the evaluation of the radiation situation in case of radiation emergency, background documents for the decision-making about measures leading to mitigation or elimination of irradiation in case of radiation emergency. These background documents are elaborated based on information submitted from the affected nuclear facility and from data provided by the

National radiation monitoring network by the SÚJB crisis staff (KŠ), which carries out its activities in the premise of the SÚJB Crisis coordination center (KKC). In the sense of the Emergency Act, the SÚJB KKC is thus a crisis management workplace.

In case of emergency situation occurrence, when preparing the background documents for the support of the decision making process, concerning the protective measures using hardware, methodical and software tools located in the KKC, the crisis staff:

- Evaluates the technology status development in relation to measures, adopted by the nuclear facility operators,
- Elaborates, in cooperation with ČHMÚ, the prognoses of radioactive materials propagation from the location of radiation emergency occurrence, and information about a possible jeopardy in the nuclear facility surroundings based on the meteorological situation and its presumed development
- Details the so-called source term of the radioactive matter release, and the extent of the affected territory.

It submits the elaborated background documents, depending on the size of the affected territory, to the Central crisis management staff / Regional crisis management staff, Safety council of the state / safety council of the region, to the government.

Further the SÚJB Crisis management staff ensures:

- IAEA notification in the sense of "The Convention on Early Notification of a Nuclear Accident" and "The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency" and points of contact of the countries based on the closed international bilateral agreements,
- Providing the public with information.

***Measures for providing the public with information, including emergency preparedness in nuclear facility neighborhood***

In the frame of informing the public within the emergency planning zones of both nuclear power plants, the license holders prepared and the SÚJB approved the documents "The public protection manual for the case of a radiation accident at Dukovany NPP" and "The public protection manual for the case of a radiation accident at Temelín NPP", distributed by both nuclear plants into each household.

The manuals inform how to proceed after the warning signal, on sheltering, application of iodine prophylaxis, and declaration of evacuation preparation, including evacuation routes depending on the meteorological situation. The power plants provide the population each year with abridgement of these manuals in form of a wall calendar.

The public receives information also at "Information Centers of the Nuclear Power Plants", and the nuclear power plants representatives and SÚJB take on request of the affected District authorities part in the information campaigns organized by the District Authorities.

### 11.1.3 Training and exercise

Nuclear power plants have developed plans for the theoretical and practical training of their employees and other persons related to the occurrence of an extraordinary event of different degree. Special plans of theoretical and practical training are prepared for persons and units assigned in the on-site emergency plan for control and performance of interventions, with emphasis on their activities during corresponding extraordinary event (each degree), in accordance with the intervention procedures established by the on-site emergency plan. Training is carried out according to the yearly training plans with special attention paid to verification of the control and intervention procedures starting from the moment of an extraordinary event occurrence, in accordance with the established intervention procedures and intervention instructions.

Emergency preparedness in the emergency planning zone in accordance with the off-site emergency plan is also being verified with help of emergency exercises, on which units defined by the off-site emergency plan for the case of extraordinary event of the degree 3 take part.

Emergency exercises of the off-site emergency plan for the given 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 progress,

- Specification of the emergency response procedures,
- Specification of hardware and intervening units engagement for the emergency response,
- Determination of persons, who will evaluate the exercise, and observers,
- Implementation: the proper process of the exercise according the prepared scenario in presence of all bodies, organizations and individual persons, responsible for the control and performance of interventions, including the activities of the persons performing the evaluation or the observers,
- Evaluation: elaborated in form of final protocol; protocols are filed as prove of the scheduled emergency exercise evaluation for long-term storage; for each calendar year all performed partial 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 interventions procedures,
- Preparation of bodies, organizations and persons controlling or performing interventions during emergency response,
- Addition of hardware, equipment and material,
- Amendment or modifications of organizational assurance of the emergency response.

In 2000 two coordination emergency exercises together with the off-site emergency response bodies took place, in the Dukovany NPP there was a participation of the Austrian party.

***Coordination emergency exercise ČEZ, a.s. –Dukovany (26.3. 2000).***

The exercise was preceded by a common preparation with the units of the Civil protection of Lower Austria, regional civil defense office in Brno, District offices Třebíč, Znojmo, Brno-venkov and the Dukovany commune. Training of population in the Austrian communes close to the border, on which participated also persons from the Dukovany NPP, was part of the preparation. The exercise was successful, it fulfilled its goals and program, and proved good preparedness of the individual on-site emergency organization units of the Dukovany NPP for the solution of situations, the probability of occurrence of which is very unlikely. Equally the system of information transfer to all external units including the foreign ones was successfully verified. During the exercise communication links between the Dukovany NPP, SURO, RÚ CO Brno and the district offices, affected by the Dukovany NPP emergency planning zone, were verified.

***Coordination emergency exercise ČEZ –Temelín NPP (30.11.2000).***

The subject matter of the emergency coordination exercise was to verify the activities of personnel of the NPP Temelín accident response emergency organization and of the NPP Temelín shift personnel during the declaration of degree 3 extraordinary event for technological causes, and a simultaneous practice of the o

ff-site emergency plan in cooperation with the District office České Budějovice, KKC SÚJB Praha and RÚ CO České Budějovice. During the exercise all specified goals were fulfilled. All communication flows and links to off-site bodies and organizations affected by the Temelín NPP on-site emergency plan worked reliably.

Czech Republic participates in international training, carried out for instance within the framework of INEX, NATO, and others.

## 11.2 Statement on implementation of the obligation concerning Article 16

The Czech Republic has implemented all measures ensuring that nuclear installations have the regularly verified on-site and off-site emergency plans, and which cover activities to be performed in the event of an accident. The plans are prepared and verified before the nuclear installation begins its operation above the minimum level of power established by the Regulatory Body. At the same time, such measures are taken which ensure that the public in the neighborhood of nuclear installation which may be feasibly affected by a radiological accident, and the relevant competent State administration bodies, receive the corresponding information for the emergency preparedness and mitigating interventions.

# 12. Siting - Article 17 Of the Convention

*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, at its location in the given place;*

*(ii) For evaluating the likely nuclear safety impact of a proposed nuclear installation on individuals, society and the environment;*

*(iii) For re-evaluating as necessary all relevant factors referred to in subparagraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;*

*(iv) For consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they 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*

## 12.1 Description of the current situation

### 12.1.1 Description of the licensing process, including the summary of national legislation

The description of the licensing process in general - for siting, designing, construction, operation and decommissioning of a nuclear installation is included in chapter 2.1.2 of the present National Report. The legislative framework applicable for issuing the site approval from the aspect of nuclear safety and radiation protection, is represented by the Atomic Act and its implementing regulations:

- SÚJB Decree No. 215/1997 Coll., on Criteria or Siting for Nuclear Facilities and Very Significant Ionizing Radiation Sources,
- SÚJB Decree No. 214/1997 Coll., on Quality Assurance in Activities Related to the Utilization of Nuclear Energy and in Radiation Practices, and Laying Down Criteria for the Assignment and Categorization of Classified Equipment into Safety Classes,
- SÚJB Decree No. 184/1997 Coll., on Radiation Protection Requirements,
- SÚJB Decree No. 144/1997 Coll., on Physical Protection of Nuclear Materials and classified radionuclide emitters.

As further mentioned in chapter 3.1.2, siting of a nuclear facility is one of the activities, to which SÚJB has to issue an approval in accordance with the Atomic Act provision of Article 9, para 1, letter a), from the viewpoint of nuclear safety and radiation protection. For issuing the approval under Article 13, following preconditions apply:

- An environmental impact assessment according to Act No. 244/1992 Coll. in the wording of the Act No. 100/2001, on Environmental Impact Assessment,
- An approval of the quality assurance program for the activity being authorized.

Application for the nuclear facility 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 a legal implementing regulation;
- Description and preliminary assessment of 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 proposed facility 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, method of quality assurance for preparatory stage of the construction and quality assurance

principles for linking stages.

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

Regulation No. 215/1997 Coll. establishes criteria for the assessment of the particular site suitability from the standpoint of nuclear safety and radiation protection. At the same time, protection of other interests resulting from the valid legislation, remains preserved. This Regulation defines the exclusion and condition criteria.

Exclusion criteria are those limiting characteristics, which unequivocally exclude utilization of a particular region for siting nuclear facilities. These criteria include radiological impacts of the planned installation under the normal operating conditions, as well as effects of the site on nuclear safety and radiation protection of the same nuclear installation.

Conditioning criteria are such characteristics which make an area or land suitable for siting nuclear facilities under the condition that it is feasible or technically possible to offset the unfavorable regional conditions, both natural ones and the ones caused by human activities.

In the implementing decree No. 195/1999 Coll. on requirements of nuclear facilities for nuclear safety, radiation protection, and emergency preparedness assurance, and in particular in the Decree No. 215/1997 Coll., on Siting Criteria for Nuclear Installations and Facilities with Very Significant Sources of Ionizing Radiation, IAEA recommendations and guidelines for the nuclear installations siting are taken into account.

The above mentioned implementing regulations of the Atomic Act, in accordance with the IAEA recommendations, require that assessments within the siting process should consider historically most significant phenomena registered in the particular locality and its vicinity, as well as combination of natural phenomena, phenomena resulting from human activity, and accident conditions due to these phenomena. Within the siting and design, nuclear installations must be evaluated as to their resistance against the following natural phenomena and phenomena initiated by human activity:

- Earthquakes,
- Climatic effects (wind, snow, rainfall, temperature of environment etc.),
- Floods and fires,
- Air crash and flying and falling missiles,
- Explosions of industrial, military and transport means, including explosions in nuclear facilities premises,
- Releases of dangerous and explosive fluids and gases.

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

### 12.1.2 Measures for fulfillment of siting criteria for nuclear installations

#### 12.1.2.1 Dukovany NPP

***Geographic position of the site***

The Dukovany NPP site is located in the southeastern part of the district of Třebíč, to the southwest from the Brno city on the right bank of the Jihlava River. Location of the site within the Czech Republic is shown in the map in the Fig. 1-1 (chapter 1 of the present National Report). Nuclear power plant is located 45-50 km from the State border with Austria. The northern part of the district is a broken stretch of land with Jihlava river valley, in the southern part it changes into a plain. The district altitude varies from 369 up to 711 m o. s. l. There are five smallish towns in the nuclear power plant vicinity - Třebíč, Náměšť nad Oslavou, Moravské Budějovice, Moravský Krumlov, and Jaroměřice nad Rokytnou. The Brno city with approximately 500 000 inhabitants is 35 km to the northeast from the plant. Within a 20 km radius approximately 105 000 inhabitants are resident. 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 is significantly lower than in other parts of the Czech Republic territory. Immediate vicinity of the nuclear power plant has unequivocally agricultural character, and there are only a few small industrial works.

***Protection against earthquakes***

Seismic assessment has been performed for the area determined by a circle with a radius of 200 km having its center in the nuclear power plant.

Geological surveys and existing information on the underlying rock under the cooling towers foundations are assessed as adequate, surveys of the area under the reactor buildings I and II and the adjacent buildings were even assessed as adequate for one hundred percent. Constructions classified in the 1st category of seismic resistance (such as the reactor buildings) are founded on a high quality underlying rock with the underground water below the level of foundations. Very high surface spring constant of the elastic bearing 200 MPa/m in the vertical direction and 140 MPa/m in the horizontal direction corresponds to a high quality underlying rock, on which the reactor building is founded. Geological maps, geological profiles and the boreholes characteristics are attached to the reports used for the preparation of the Pre-operational Safety Analysis Report for nuclear power plant Dukovany, revision 1 [12-1].

At Dukovany site, the greatest possible effects of an earthquake may be expected, according to historical data, from the Alps seismic focuses. It results from the analyses considering both the greatest possible magnitude of shocks and most adverse attenuation of intensities from the distances in the direction seismic focus - Dukovany that entirely theoretically a maximum of macro-seismic intensity, which may be expected at Dukovany site, is 6° MSK. Calculations of the seismic risk have resulted in the limiting value of macro-seismic intensity of 5.8°MSK, which should not be exceeded even within 10 000 years period.

Analyses performed at the same time confirmed the non-existence of any local tectonic shocks. Actually no observed effects of any earthquakes were reported for Dukovany village. Closest local shocks originated in Jindřichův Hradec area, where epicentral intensities did not exceed 5°MSK-64, and the macroseismic fields of which did not reach the Dukovany region.

Based on the above and using the most conservative approach, following seismic characteristics may be obtained:

- Design basis earthquake is equal to the maximum historically observed earthquake in the area, i.e. 6° MSK-64,
- Safe shutdown earthquake is equal to the maximum estimate of the maximum possible expected earthquake, i.e. 6° MSK-64 + 0.5° MSK-64 (error in the determination of intensity).

This means unambiguously that due to seismically entirely calm area and stability of the underlying rock, the Dukovany NPP cannot be endangered by a seismic event. Despite that, as a contribution to safety, maximum conservative approach has been used, and in compliance with the IAEA recommendations and considering the results presented above, level SL-1 equal to 6° MSK-64 and level SL-2 equal to 0.1 g acceleration (which in the conditions of Central Europe corresponds to the intensity of 7° MSK-64 - higher than the most conservative estimate of the safe shutdown earthquake) were specified for the Dukovany site.

***Protection against floods and adverse climatic phenomena***

The largest river in the vicinity is the Jihlava River, to the north of the nuclear power plant, from which service water is taken and into which the waste water is discharged. The power plant site is located approximately 100 m above the maximum levels. On the Jihlava River, near the power plant a system of waterworks Dalešice – Mohelno, forming a pumped-storage hydro-electric power plant, was built. Jihlava River flow at the in-flow to waterworks Dalešice varies around the average annual value of 6 $m^3s^{-1}$.

Analysis of floods and prediction scenarios of floods show that the locality of the Dukovany NPP never was, and is not endangered even now, by floods.

Specific knowledge of the meteorological situation in the vicinity of the nuclear power plant is necessary to determine influence of cooling towers and to assess the radioactivity spread; therefore a special attention was paid to cumulate such knowledge. Nuclear power plant vicinity is located within Atlantic-continental area of temperate climatic zone of the northern hemisphere. Here, in the course of a year, air masses of oceanic and continental origin alternate, which is connected with frequent passages of atmospheric fronts. Specific meteorological measurements and observations at the site have been carried out without interruptions 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.

Adverse meteorological conditions for the locality in question, such as windstorms, precipitation and extreme temperatures have been took into account in the design.

***Protection against effects caused by aircraft crash***

Airspace above the nuclear power plant has been proclaimed prohibited for all flights in the document ”Flight Information Manual” which is obligatory for all users of the Czech Republic airspace.

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 maters is a prohibited space for airplanes.

The analyses have shown that the plant is protected against effects caused by both a military and a civil aircraft crash. Assessment of these effects was performed in accordance with the International Civil Air transport Organization (ICAO) guidelines. 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 function of the reactor emergency shutdown and cooling.

***Protection against explosion pressure waves***

Near the Dukovany NPP, in a distance of about 500 meters, there is a second class road (No. 15) - Brno, Ivančice, Dukovany, Znojmo, Jaroměřice nad Rokytnou, Moravské Budějovice. Other roads in the vicinity are less frequented. The analyses have shown that even in the case of very improbable explosion of a transport vehicle carrying a dangerous freight, plant safety will not be affected in any way.

The plant has a railway siding from eastern direction Moravský Krumlov and Brno. 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.

***Protection against influence of third parties***

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

#### 12.1.2.2 Temelín NPP

***Site geographic position***

The Temelín site was selected at the seventies/eighties turn as a result of evaluation of the parameters of the territory established by the Edict No. 4/1978 Coll., valid at that time (refer to the review of the legislation development in chapter 2 of this National Report). Location of the site in the Czech Republic is shown in the map in the Fig. 1-1 (Chapter 1 of the present National Report). The plant is at a distance of 45-50 km from the State borders with Austria and Germany. The nearest permanently inhabited locality is the village Temelín - at a distance of 2 km in north-west direction. Distance from Týn nad Vltavou with 7 900 inhabitants is 5 km, and from the Vodňany town with 6 400 inhabitants is 14 km. The České Budějovice city is in a distance of 25 km and its population is approximately 100 000. Approximately 256 000 persons lived within a radius of 30 km around the plant, according to general census of the population in 1991. Population density in other parts of the territory is very low, with only small settlements.

Again, the site has been selected in a way to minimize possible interactions of the nuclear facility with the adjacent territory. Thus, in the immediate vicinity there are no large industrial facilities, with exception of pipeline of the transit gas line, or frequented transport routes. Density of industrial facilities in South Bohemia is significantly lower than in other parts of the Czech Republic territory. Immediate vicinity of the nuclear power plant has unequivocally agricultural character, and there are only a few small industrial works. According to the District Authority of České Budějovice, no industrial development in 10 km area in the perspective up to 2020 is planned.

***Protection against earthquakes***

Despite the fact that the Czech Republic territory belongs among the geologically well surveyed territories, another detailed assessment of the geological bedrock up to the distance of 30 km had been performed in relation with the nuclear power plant siting. Original geological surveys performed during the eighties have been supplemented by 1991-1994 surveys in accordance with the IAEA recommendations.

Geological underlying rock of the locality is represented by South-Bohemian branch of Molanubikum and South-Bohemian basins. Both units belong to the Bohemian massif, which was created by the end of Paleozoic Era in the final phase of Varisk rock forming cycle. Most frequent rock here are gneisses, granites and quartz. The plant site has a rock substratum; the reactor buildings are positioned on a homogeneous block with a size exceeding

500 x 500 m. Geomechanically, the plant underlying rock has a sufficient foundation bearing capacity for buildings and equipment of the nuclear power plant.

Seismic assessment has been performed for the whole area under interest, delimited by a circle of 300 km radius having its center in the power plant. The biggest part of this area lies within the Bohemian massif territory, in the south and southeast it reaches Alps-Karpatian region. Moldanubikum under the NPP is the oldest and most strong part of the Bohemian massif. The seismic risk value is determined by Alps earthquakes. Results of the seismologic analyses show that there are no known cases of local tectonic shocks.

The earthquake catalog was supplemented in accordance with the IAEA recommendation 50-SG-S1 rev. 1. It is one of the important reference documents of the preoperational safety report, and starts with the year 1550.

It results form the assessments based on the greatest possible shocks in the focus areas located directly in the concerned area and most adverse attenuation of intensities with the distance seismic focus - NPP that the limiting value of macro-seismic intensity which should not be exceeded with 0.95 probability even within 10 000 years period is $6.5^{o}$ MSK-64, which corresponds to 0.1 g in the conditions of Central Europe. Design acceleration was 0.1 g, which is fully conform to the IAEA recommendations issued in 1991. These values have been used both in design and construction of buildings and equipment necessary to ensure a safe shutdown of the reactor, removal of residual heat and prevention of radioactive substances release (classified in the category 1 of seismic resistance).

***Protection against external floods and adverse climatic phenomena***

Operation of the power plant is dependent on the Vltava River, from which process water is taken and into which the waste water is discharged. Vltava river represents a main axis of the Czech river system, and a number of water reservoirs which had been built on it years ago, forming the so called Vltava river cascade, it serves to protect against flooding and some of them help to generate hydroelectric power. A significant benefit provided by the cascade reservoirs is the equalization of the minimum flows. For the needs of the Temelín NPP, two water reservoirs were added to this cascade: Hněvkovice from which technological water will be taken, and Kořensko, which will be used to mix the discharged waste water with Vltava water.

Analysis of floods and prediction scenarios of floods show that the locality of nuclear power plant has never been, and is not endangered by floods. Main plant buildings, housing equipment important for nuclear safety, are built at the altitude of 510 m a. s. l. It results from the assessment of historic extreme flows that the plant area is approximately 150 m above the maximum levels. The site has been also assessed from the aspect of possible destruction of water reservoirs on upper course of the Vltava River. Break of the Lipno I dam will cause 1460 $m^3s^{-1}$ flow in Hněvkovice profile, which will not affect either Hněvkovice dam or the pumping stations of process water.

Specific knowledge of the meteorological situation in the vicinity of the nuclear power plant is necessary to determine influence of cooling towers and to assess the radioactivity spread; therefore a special attention was paid to cumulate such knowledge. Nuclear power plant is located within Atlantic-continental area of temperate climatic zone of the northern hemisphere. Here, in the course of a year, air masses of oceanic and continental origin alternate, which is connected with frequent passages of atmospheric fronts (average of 125 fronts a year). Prevailing are such meteorological situations when fronts come from the west, in a lesser degree - from the north. The specific meteorological measurements at the site have started at the time when the meteorological observatory was being built. The observatory is located at a distance of 3 km from the nuclear power plant in the northwest direction. The measurements were started in April 1988, and are carried out without interruptions since January 1989.

Adverse meteorological conditions for the locality in question, such as windstorms, precipitation and extreme temperatures have been took into account in the design.

***Protection against effects caused by aircraft crash***

Airspace above nuclear power plant with a radius of 2 km and height 1500 m has been proclaimed prohibited for all flights by the flight information manual. The nearest flight corridor is situated 18 km from the plant. Thus, air traffic has no effect on the nuclear power plant. The military airfield at Bechyně, located 25 km from the plant, was liquidated.

Analyses have shown that the plant was protected against effects caused by a military and civil aircraft crash. Assessment of these effects was performed in accordance with the International Civil Air transport Organization (ICAO) guidelines. Results of the calculations have shown that the aircraft crash would not cause inadmissible destruction of the primary system because its civil constructions, important for nuclear safety, are sufficiently

resistant against possible impacts of such a crash. The analyses have also shown that the spatially isolated back-up core cooling systems, together with civil construction, ensure that even an aircraft crash will not affect function of the reactor emergency shutdown and cooling.

***Protection against explosion pressure waves***

Around the nuclear power plant 3 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. Results of the analyses have shown that even the maximum postulated accident on the gas line (simultaneous break of all three branches) would not impair functions of the buildings and technological equipment. A series of measures was adopted to reduce the probability of 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 the system for natural gas leakage monitoring. Calculations and analyses performed by professional organizations and research institutes were assessed positively by the SÚJB.

At the site southeast boundary there is a frequented secondary road No. 105 České Budějovice - Týn nad Vltavou, other roads in the plant 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 a dangerous freight, the plant safety will be not affected.

The nearest railway situated about 1.4 km from the plant is the local railway line Číčenice - Týn nad Vltavou with passenger and goods trains. Passenger trains are very infrequent. On this line, probability of an accident of a train with dangerous goods both at present and in long-term prospect is practically zero.

***Protection against influence of third parties***

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

### 12.1.3 Activities leading to preliminary assessment of nuclear installations siting

New Regulation No. 215/1997 Coll. for nuclear installation in operation, requires that impacts of the external events mentioned in the previous chapters should be re-evaluated, either after a certain time of operation or within the framework of the regular revisions of safety documentation, applying a most advanced scientific and technical tools and taking into account any changes which have occurred at the locality.

### 12.1.4 Assessment of environmental impact of a nuclear power plant

In the Dukovany NPP vicinity monitoring and assessment of its impact on the environment is carried out systematically. In the Temelín NPP the environment components are monitored in accordance with the prepared monitoring plan already for many years in way to have the basic data in advance prior putting the plant into operation. For details, refer to Chapter 10 of this National Report ”Radiation protection”.

In the frame of the so-called Melk protocol, closed in December 2000 between the prime ministers of the Czech republic, Austria, and the EU commission, a complete 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 directives dealing with the assessment of impact of projects on the environment. It was an above standard assessment of the project, which was already almost finished.

The assessment was performed in the following areas:

- Climate and atmosphere
- Hydrology
- Geology and seismicity
- Impact on the population health
- Influence on the nature and landscape
- Wastes (including the radioactive ones)
- Evaluation of impact of design basis accidents.

The commission having performed the assessment concluded that the impact is small, insignificant, and acceptable. In the conclusion, the commission recommended 21 measures directed in particular to intensifying the monitoring of all influences during the future plant operation.

### 12.1.5 International agreements on nuclear installations siting

In accordance with bilateral intergovernmental agreements with Federal Republic Germany and Austria, the Czech Republic submits to the governmental bodies of these States information on its nuclear installations (including the Temelín NPP which is under construction), situated near common border. Information is transferred both regularly (annual meetings) and irregularly, within the agreed meetings, or in writing.

During the above mentioned Melk process, during which also Temelín NPP safety issues were discussed, unprecedented amount of information was submitted to the Austrian party concerning the design, safety analyses, and analyses of the environmental impact of the operation. In the safety issues area, Czech republic cooperates also with other neighboring countries, in particular with FRG.

The Czech Republic has also signed a general intergovernmental agreement on the exchange of information with another neighboring country - the Slovak Republic. The obligation to inform about events significant for nuclear safety is stipulated in the Co-operation Agreement on the State Supervision over Nuclear Safety and Nuclear Materials between the Czech Republic and Hungary.

## 12.2 Evaluation of Article 17 Of the Convention implementation status

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 environmental impact. At the same time, it introduces the regular re-revaluation 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 at the locality. It also follows that requirements of the legislation were implemented into the practice. The requirements of Article 17 of the Convention are in the Czech Republic fulfilled.

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# 13. Design and construction - Article 18 Of the Convention

*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 their 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.*

## 13.1 Description of the current situation

### 13.1.1 Description of the licensing process including the summary of national legislation

General description of the licensing process for siting, designing and construction, operation and decommissioning of nuclear installations is contents of the chapter 2.1.2 of the present National Report.

The legislative framework governing the issue of a construction approval which covers the nuclear safety and radiation protection aspects, is established by the Atomic Act and its implementing regulations, in particular:

- Decree No. 195/1999 Coll. on requirements for nuclear facilities for the assurance of nuclear safety, radiation protection and emergency preparedness.
- SÚJB Decree No. 214/1997 Coll., on Quality Assurance in Activities Related to the Utilization of Nuclear Energy and in Radiation Practices, and Laying Down Criteria for the Assignment and Categorization of Classified Equipment into Safety Classes,
- SÚJB Decree No. 184/1997 Coll., on Radiation Protection Requirements,
- SÚJB Decree No. 144/1997 Coll., on Physical Protection of Nuclear Materials and classified radionuclide emitters.

As further mentioned in chapter 3.1.2, construction of a nuclear facility is one of the activities, to which SÚJB has to issue an approval in accordance with the Atomic Act provision of Article 9, para 1, letter b), from the viewpoint of nuclear safety and radiation protection. For issuing the nuclear facility construction approval under Article 13, following preconditions apply:

- Approval of a quality assurance program for the approved activities
- Approval of the quality assurance program for the design.

Application for an approval for nuclear facility construction must be, in accordance with the Appendix B of the Atomic act, documented by the following documentation:

I. Preoperational Safety 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 presumed lifetime of the nuclear installation;
   - Concept of safe termination of operation and decommissioning of the approved 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 linked phases;
   - List of classified equipment.

II. Physical protection assurance proposal

After positive assessment of the above documentation SÚJB will issue the construction permit, whilst the List of Selected Items and proposed physical protection method are subject to a separate approval by the SÚJB

### 13.1.2 Dukovany NPP

***Basic nuclear safety principles included to the nuclear power plant design, including the application of the defense-in-depth strategy***

Technological description of the Dukovany NPP units is given in Appendix 1.

The 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 operators and public from outer and inner irradiation and surrounding environment from contamination by radioactive substances within approved standards. This should be assured both during long-term stationary operation and anticipated accident conditions.*"

Other criteria were there established only implicitly as references to technical standards of the former USSR. The "Technical Substantiation of Safety" (1974) served as basis and already before the putting of the Dukovany NPP into operation a series of Czech and Russian normative documents, which were taken into account when elaborating the original technical design into the particular design of the Dukovany NPP. 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 nineties (refer to chapter 1 of this National Report) with the current requirements, it is possible to state that the Czechoslovak legislation of the eighties (and in principle also the regulations of the former USSR, which were subjected to similar development) was on a very good level. Generally, they were conform to the contemporary understanding of nuclear safety, and their criteria, to a considerable extent, coincide with the current ones.

The technical design defined the so-called "design basis accident" - double ended rupture on the cold leg of the primary circuit (nominal diameter 500 mm) in the inseparable part of the reactor inlet.

The design than considers technical and organizational measures to assure nuclear safety in the event of a single failure of the normal operating equipment simultaneously with an undetected failure of other normal operating equipment. Simultaneously with the normal operating equipment failure of one independent safety division is investigated. The safety analyses included in the Safety Analysis Report are performed for the defined set of initiating events.

The Dukovany NPP design respects the defense-in-depth concept defined in the IAEA INSAG-3. It is based on several protection levels, which include the consecutive physical barriers, preventing radioactivity release into the environment:

- Level 1: A conservative design,
- Level 2: Control of deviations from the normal operation and detection of failures,
- Level 3: Safety systems and protection systems,
- Level 4: On-site crisis management, including localization system,
- Level 5: Off-site emergency planning.

The most complex assessment of VVER-440/213 units, in the light of defense-in-depth implementation, has been performed within the extra-budget IAEA program in the period of 1991 - 1998 (see chapter 1 of this National Report). The program was organized with the objective to identify deviations of the VVER-440/213 design from the current safety standards. Safety significance of the individual equipment (system) was assessed on the basis of its contribution to the defense-in-depth degradation.

Output document [1-5] of the program comprised also recommendations for elimination of established deviations.

From these general findings, the NPP has subsequently selected the ones relevant in particular for the Dukovany design, and has elaborated a program of measures for their elimination. Majority of the corrective measures has been already implemented before the elaboration of the present National report (all of them with higher priority). IAEA mission in 1996 organized for that purpose, has positively assessed the program of corrective measures implementation (refer to [1-6]).

Results of the Dukovany design assessment, Operational safety report, and successful implementation of the corrective measures program are considered as one of the main evidences that the design and the construction of the nuclear installation provide several reliable protection levels and approaches (defense-in-depth) against radioactive material release, for the prevention of accidents and mitigation of possible radiological consequences.

***Human factor and man - machine interface related design features***

The operation of the Dukovany NPP has unequivocally proved that the design of this nuclear installation ensures its reliable, stable and easily controlled operation. Over the years, the plant underwent a number of modifications made with the objective to minimize the possibility of a human factor error and to improve the man-machine interface, especially in the process control system. Additional modifications are scheduled within the Modernization Program of the Dukovany NPP (refer to Annex 5). These modifications are focused both on control rooms and on the simplification of regular performance tests of individual equipment. Some of the prepared modifications will increase the share of automatic control and thus enable to reduce the number of necessary operator interventions and consequently to reduce number of potential human errors.

For a reliable and safe operation with emphasis on human factor and man-machine interface, both the design and the technical tools of the control room are very significant. The control room concept in VVER-440/213 units, in its Dukovany NPP specific modification, provides:

- Very good overview of the equipment condition, which enables a fast and easy orientation of the control room personnel during normal operation as well as during transients. The original situation has been improved further by changes in the instruments ergonomic design implemented as a result of the operators initiative,
- Easy and fast equipment control from the control room,
- Appropriate design of the failure and emergency warning systems which contributes to timely and correct identification of failures. Innovations were implemented here with emphasis on improvement of the man-machine interface,
- Appropriate combination of analog (classic) type of the control room with digital elements – computer based equipment, which is gradually implemented to the control room. More extensive computerization improves the personnel's work efficiency and has a favorable effect on the man-machine interface and thus - limits errors due to "human factor". This concerns in particular a series of supporting computer programs performing auxiliary calculations enabling to utilize the documentation in digitized form, etc.,
- In the communication area - the original design was supplemented by up-to-date digital telecommunication means. This improved significantly the communication between the unit control room personnel and service personnel during the handlings controlled from the main control room.

### 13.1.3 Temelín NPP

***Basic principles of nuclear safety included in the nuclear power plant design, including application of the defense-in-depth strategy***

Technological description of the Temelín NPP units is given in the Annex 1 to the present National report.

In the present time the design is finished and modified so that both units are, in the moment of their commissioning, on a level fully comparable with up-to-date nuclear power plants in Western Europe and in the USA as to the level of nuclear safety assurance and other properties.

Basic design of the Temelín NPP units 1 and 2 was elaborated by the Czech design organization Energoprojekt (EGP) Praha. The inland experts have analyzed and modified the original design already before 1989. Further technical improvements have resulted from IAEA missions recommendations, SÚJB recommendations, proposals of the future operator and of many Czech experts and from the results of the External Audit by NUS Halliburton (refer to [1-21]). Their implementation will bring the technical level of units 1 and 2 of Temelín NPP into compliance with the standards of western nuclear power plants according the requirement for the end of the nineties.

Design changes were then verified by new analyses performed with advanced western computer codes, both in depth and structure conform to the requirements of western standards.

Significant changes of the design are described in the in the Chapter 1.1.3.2 of the National report. A detailed description of the design is given in the Annex 1.

To reach and to maintain the required level of nuclear safety, the Temelín NPP is designed to be compliant with generally applicable regulations for nuclear safety assurance, and fulfills following safety principles and functions:

- Capability to shutdown safely the reactor and maintain it in conditions of safe shutdown under all operating modes and events anticipated in the design,
- Capability to remove residual heat from the core under all operating modes and events anticipated in the design,

- Capability to minimize any possible leakage of radioactive matter in a way not to exceed the stated limits in all operating modes and events anticipated in the design and after them.

Observance of these general principles is achieved by adhering consistently to the defense-in-depth principles and by fulfilling safety functions as described in the safety standards and IAEA instructions and in the INSAG 12 document. Personnel and environment of the nuclear power plant are protected against consequences of any serious accidents by physical barriers comprised of:

- Nuclear fuel matrix (practically all fission products are retained within the matrix of the uranium dioxide pellets),
- Fuel rods cladding (fuel cladding is made of the special alloy Zircaloy to remain hermetic over the whole time of utilization and thus preventing the fission products release),
- Primary circuit (reactor pressure vessel and the primary circuit represent a barrier resistant to pressure load, heat and radiation exposure),
- Containment - pre-stressed concrete dome (external 1.2 m thick containment covers the reactor and all important primary circuit equipment, and thus prevents radioactivity releases into the environment in the event of an accident related with the integrity damage of the preceding barriers).

In 1996, special mission of the IAEA checked how the innovated design of the Temelín NPP reacts to the IAEA safety issues, generic for nuclear power plants with VVER-1000 reactors described in the IAEA document [1-19]. Individual safety issues were, similarly as in the case of units with VVER/440-213 type reactors, categorized in accordance with the defense-in-depth possible violation viewpoint. The mission evaluated the design, implementation of modifications recommended earlier, and the preparation for operation, including the issue of the design compatibility (implementation of western technology into the original design). The mission recognized a general improvement of the Temelín NPP design. The mission emphasized that the combination of eastern and western technology was considered with a great care. In some cases, combination of eastern and western technology led to a safety improvement even when compared with international practice. Such positive evaluation, besides other, confirms that the design of the Temelín NPP conforms to the defense-in-depth concept.

## 13.2 Evaluation of the implementation status of the Article 18 Of the Convention

The legislation valid in the Czech Republic and its implementation into the practice is compliant with the requirements of Article 18 of the Convention. The operated Dukovany NPP and commissioned Temelín NPP are designed with respect to the defense-in-depth concept with the goal to prevent occurrence of accidents and to mitigate their consequences. Applied technologies are either well proven or verified by the tests combined with computational analyses.

# 14. Operation - Article 19 Of the Convention

*Each Contracting Party shall take appropriate steps to ensure:*

*(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 license to the regulatory body;*

*(vii) Program 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.*

## 14.1. Description of the current situation

### 14.1.1 Description of licensing process, including summary of national legislation

The licensing process, in general for siting, designing and construction, operation and decommissioning of nuclear installations is given in the chapter 2.1.2 of this National Report.

The legislative framework for approval of the operation of a nuclear facility from the nuclear safety and radiation protection is established by the Atomic Act and its implementing regulations, in particular:

- SÚJB Decree No. 106/1997 Coll., on Nuclear Safety and Radiation Protection Assurance during Commissioning and Operation of Nuclear Facilities,
- SÚJB Decree No. 214/1997 Coll., on Quality Assurance in Activities Related to the Utilization of Nuclear Energy and in Radiation Practices, and Laying Down Criteria for the Assignment and Categorization of Classified Equipment into Safety Classes,
- SÚJB Decree No. 184/1997 Coll., on Radiation Protection Assurance Requirements,
- SÚJB Decree No. 144/1997 Coll., on Physical Protection of Nuclear Materials and classified radionuclide emitters.

As it was said in chapter 3.1.2, commissioning and operation of a nuclear installation are activities for which SÚJB authorization is required under the Atomic Act (Article 9, para 1, letters c) and d)) as to nuclear safety and radiation protection. According to Article 13, para 5, approval of a quality assurance program for the activities being authorized is prerequisite for issuing the authorization.

***Commissioning***

An application for the issue of authorization for the individual stages of nuclear installation commissioning must be, in accordance with 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 works in the given phase;
- Program for the given phase;
- Evidence of equipment and personnel preparedness for the given phase;
- Evaluation of results of the preceding phase;
- Method by which physical protection is to be provided.

b) For the first loading of nuclear fuel into a reactor

I. Pre-operational safety report, which must include:

- Description of changes to original design assessed in the preliminary safety report and evidence that there has been no decrease in the level of nuclear safety;
- Supplementary and more detailed evidence of nuclear safety and radiation protection provisions;
- Limits and conditions for safe operation of the nuclear facility;
- Neutron-physics characteristics of the reactor;
- Method of radioactive waste management;
- Quality evaluation of classified equipment;

II. Further documentation, which must include

- Evidence that all prior decisions and conditions of SÚJB were fulfilled;
- Time schedule for nuclear fuel loading;
- Program of nuclear fuel loading;
- Evidence of equipment and personnel preparedness for the fuel loading;
- Evaluation of the results of previous phases;
- On-site emergency plan;
- Changes of physical protection assurance;
- Program of in-service inspections;
- Proposed decommissioning method;
- Cost estimate for decommissioning.

c) For phases following the first nuclear fuel loading into the reactor

- Time schedule for works in the given phase;
- Program of the given phase;
- Evidence of equipment and personnel preparedness for the given phase;
- Previous phase results evaluation.

After a positive evaluation of the above documentation, 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, are subject to a separate approval by the SÚJB.

***Operation***

Application for issuing the authorization for the nuclear facility operation must be, in accordance with Appendix D to the Atomic Act, accompanied with the following documentation:

- Supplements to the pre-operational safety report and further supplements to documentation required for the issue of the authorization 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 phases;
- Evidence of the fulfillment of previous decisions and conditions of SÚJB;
- Evidence that installation and personnel are prepared for operation;
- Operation time schedule;
- Updated limits and conditions for safe operation.

After positive evaluation of the above documentation, SÚJB issues the authorization for nuclear facility; changes in the documentation, which were approved within the previous stages, are subject to a separate approval by the SÚJB.

Although the authorization for operation under the Act is not time-limited, SÚJB issues during the operation, in accordance with the Article 9 para 1 item e), 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-physical characteristics of the 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.

The following paragraphs describe the situation in the Dukovany NPP, which is the only nuclear power plant in operation in the Czech Republic.

### 14.1.2 Limits and Conditions for safe operation

Concept of the Limits and Conditions for safe operation has been formulated as early as 1982 following an initiative of the regulatory body, the former ČSKAE. It was based on the US NRC reference guide [14-1] for nuclear power plants with pressurized water reactors. The first version of the Limits and Conditions for the Dukovany NPP units was put into use in 1983 as a first application for VVER reactors. Since that time, the Limits and Conditions have been systematically developed and more detailed.

The Limits and Conditions for safe operation contain a set of data on:

- Acceptable parameters,
- Requirements for equipment operation ability,
- Protection systems settings,
- Basic assumptions and operations of personnel during defined operating conditions and organizational measures.

They include the following categories of data:

- Safety limits,
- Protection systems settings,
- Limits and conditions for the normal operation modes,
- Requirements for checks.

In case any deviation from the Limits and Conditions occurs, 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 tripped and cooled down. In accordance with the principles, it is a duty of the operator to inform the regulatory body and subsequently an analysis of the Limits and Conditions violation is performed, measures preventing repetition of such event are proposed.

The Limits and Conditions are modified according to science and technology development, implemented modernization of the nuclear power plant and the experience acquired.

Establishment of Limits and Conditions of safe operation was required both by the original Czech legislation and the existing Atomic Act, as one of the basic documents for issuing the authorization of first fuel loading. Subsequently their updated version must be presented together with the application for authorization for nuclear facility operation.

***Limits and Conditions of the Dukovany NPP***

Limits and Conditions for safe operation of the Dukovany NPP are based on calculation and experimental analyses and data and are also based on operational experience not only from the Dukovany units with the VVER 440/213 reactors, but also from units in other countries (Slovakia, Hungary, Russia). During 2001 updated limits and conditions for safe operation of the Dukovany NPP were put into force to make their contents and internal segmentation compliant with the requirements of the Act No. 18/1997 Coll. and the SÚJB Decree No. 106/1998. The reworked L&C include also substantiation. These L&Cs are elaborated in accordance with the NUREG 1431 document [14/1a] and the requirements are based on the prerequisites of safety analyses, documenting the plant safety at abnormal and emergency conditions. Limits and Conditions are closely related with operational regulations for operation and maintenance of individual systems and equipment and with accident analyses in safety reports.

The operational procedure ”Limits and Conditions for the Dukovany NPP operation” was reevaluated in 1995 from the PSA viewpoint. The result of the above was an addition and reworking of several new limit conditions and modification of allowed unavailability times of some equipment. Limits and Conditions were reworked in 2001 with application of the PSA results.

***Limits and conditions of the Temelín NPP***

Limits and conditions of the Temelín NPP were elaborated in accordance with the NUREG 1431 document [14/1a] and their requirements are based on the prerequisites of safety analyses, documenting the plant safety at abnormal and accident conditions. Contents and internal segmentation of the Temelín NPP limits and conditions are compliant with the requirements of the Act No. 18/1997 Coll. and the SÚJB Decree No. 106/1998. Limits and Conditions of the Temelín NPP are part of the Preoperational safety report. They were approved by SÚJB as an independent document within the licensing procedure for the authorization of the first fuel loading to the reactor core. Limits and Conditions documentation, which is used by the plant personnel, is composed of two parts:

1) Limits and Conditions of safe operation
3) Substantiation of the Limits and Conditions of safe operation

Each system in the Temelín NPP is classified either as ”important or unimportant for the safety”. Systems important for the safety are such systems, the availability for operation of which ensures the fulfillment of any of the safety functions. Systems important for the safety are divided in two subcategories:

1) Safety systems and 2) Safety related systems

Both these subgroups are covered with requirements of Limits and Conditions. Safety systems may further be classified as protection (actuating) systems, actuators (which are being actuated in case a certain predetermined value is exceeded) and supporting systems. Similarly it is possible to perform this division also for safety related systems. Here the actuators are controlled by the control systems of the safety related systems rather than by protection systems (limitation system, reactor control system etc.).

### 14.1.3 Operation, maintenance, inspections and tests of nuclear installation

***Operation***

Units of both power plants are operated in accordance with internal regulations and the Limits and Conditions for safe operation. These documents are continuously and systematically updated and upgraded. The compliance with the documents is continuously monitored through the implemented control system and so called ”feed-back” system (refer to the Chapter 14.1.7 of the National report).

Internal audit of the Power Company ČEZ a.s. in the Dukovany NPP has confirmed that the process of feedback from internal and external events (IRS-MAAE/NEA, WANO, WWER) is functional and effective. Internal audit did not propose any corrective measures or improvements of the current status.

The system catches all necessary and usable events. The plant personnel is 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 decreases already for several consecutive years.

In the Dukovany NPP a system of WANO indicators evaluation is implemented, it provides continuous information about the standards in the areas under study in other NPPs in the world and the gathered information is used to recognize own level of the Dukovany NPP in the individual indicators of the safety and operation status. Safety indicators overview of all Dukovany NPP units in the years 1995-2000 is given in the Annex No. 7 to the National report.

Causes for repeatedly occurring events are evaluated on a regular basis. In events discussed by the commission for the investigation of events (safety relevant) no repeatedly occurring events were identified. Repeated events (problems) monitored in the category of small events (without a direct impact on nuclear safety) are also regularly evaluated in the yearly report and their elimination is continuously followed and evaluated.

Corrective measures fulfillment success rate is also part of regular yearly evaluation of the feedback in the power plant. In the past period it was mostly possible to fulfill the corrective measures and eliminate thus the causes of discrepancies in the scheduled dates.

Legislation related to the external feedback process was updated in accordance with the requirements resulting from the real assessment, evaluation, and external information utilization process. New guideline of principles describing the contact of Dukovany NPP with the WANO organization was issued.

Basic system standards establishing principles for safe and reliable operation control in the Dukovany NPP are the Operation Control Rules [14-2]. General requirements for safe and reliable operation and maintenance in the Temelín NPP are established in the quality assurance document ”Technical controls, principles of operation and

maintenance" [14-2a]. Rules for shift operational control are included in the QA document "Operations control" [14-2b].

The Operations control rules are formulated so that their observance shall ensure safe, reliable and economic and environmentally friendly operation of the nuclear installation, conform to:

- Conditions of the SÚJB authorization,
- Provisions of the binding legal regulations of the Czech Republic (acts and their implementing decrees),
- Operating procedures.

Operation of the Dukovany 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 competence of operating personnel, especially so-called "selected personnel", i.e. personnel who have an immediate effect on nuclear safety (see chapter 6 of this National report). Also other operating personnel similarly undergo selection, training and hands-on training for the relevant function.

Shift operation in the Dukovany 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.

During unit operation at the output of (about > 55% Nnom), the Dukovany NPP uses the PSA risk monitor application for monitoring the unit operation risk. Data about unavailability of equipment are analyzed for the reasons of tests, maintenance, and failures in all four Dukovany NPP units. The analyses result in measures leading to the minimization of the operational risk in the Dukovany NPP.

When planning the equipment tests and maintenance, the outputs of the risk monitor are used to eliminate combinations of equipment unavailability, which are indeed allowed by Limits and Conditions, but could increase the operational risk in the Dukovany NPP.

***Organization and activities during yearly outages***

Preparation and progress of the outage in the Dukovany NPP is controlled by a group of persons, nominated by the Coordination department manager in the following composition:

outage manager
primary circuit working group head
secondary circuit working group head
electro working group head
measurement and control working group head

Shift maintenance dispatcher, which controls and checks the works 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 about the current state of the monitored activities, and where tasks directed to the fulfillment of the plan of works are assigned.

After the consultation meetings, consultation meeting of the outage axis is held, on which, additionally to the heads of the working groups, the reactor unit manager and shift maintenance dispatcher are present. During this meeting tasks for the next 24-72 hours are assigned. Orders for the shift personnel are also consulted here, which are concentrated into an official document, named Daily operational schedule and which is being issued daily.

Fulfillment of the assigned tasks is then checked and evaluated during the consultation meeting of the shift maintenance dispatcher in presence of the outage manager and the heads of the working groups, which is held the following day on 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 six months prior the scheduled date of its beginning, in accordance with the yearly outages scheduled. The yearly schedule is linked to the long-term plan of plant outages, where also the presumed duration of the outage is given based on the standard whilst taking into account long-term extensive activities.

- Basic skeleton of the main activities is determined based on regular periodic checks of the main components of the unit.
- Important scheduled reconstructions and modifications are included.
- Preparation of complex activities, such as special inspections, plant modifications, may be in progress even several years prior the corresponding outage.
- Six months prior the corresponding outage, fulfillment check of the conclusions and measures from the preceding outage is performed.
- Six months prior the outage, regular Coordination consultation meetings are started
- Requirements for execution are further detailed, simultaneously preparation of activities from the viewpoint of material assurance, documentation, selection of the contractor, approval by the regulatory body, etc. is in progress
- Two months prior the outage the Coordination department issues the official schedule of the outage, created using the network planning method. The schedule includes decisive activities, which will be performed during the outage. It includes revisions of the main components of the unit, 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. It includes already the sequence of important unit tests during the unit start-up. In the schedule the so-called critical path of the outage activities is marked.
- Two months prior the outage preparation of the work orders for scheduled outage activities is finished and works start on grouping the work 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 State office for Nuclear Safety (SÚJB).
- One week prior the outage 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. Similar document is elaborated also for the activities during the unit start up after the outage.
- At the beginning of the outage the program of checks for the State office (SÚJB) inspectors is approved and contact persons from the side of the plant are assigned.
- Two days prior the reactor start-up an expert commission meets to judge, based on report about 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 regulatory body (SÚJB).
- Within one month after the putting the reactor into operation a report about the performed repairs on the classified equipment is submitted to an independent supervision body (ITI).
- Within two months after the outage, a summary report about the outage including recommendations and measures for later outages is elaborated.

The outage structure is governed by the following philosophy:

- One critical path is clearly defined.
- During the outage systems and components will be put out of operation and secured only once.
- During the outage the PSA (Core damage frequency) shutdown study recommendations are took into account.
- Systems and components with finished maintenance are tested in accordance with the approved procedure. These tests are performed by the Operations control department prior to place them into normal operation.
- Progress of works being in the critical path and in its vicinity is followed in detail.
- Information about the overall progress of the outage belongs to the information frame being submitted to the outage coordination group.

***Maintenance***

The mission of the maintenance in the Dukovany NPP is to provide and controls all activities on plant equipment so that they are:

- In accordance with the plant design,
- In accordance with the Czech Republic legislation,
- In accordance with international recommendations,
- In accordance with the internal control documents,

and, at the same time, the following is assured:

- Nuclear, radiation and conventional safety,
- Required reliability,
- Design lifetime of the equipment
- Limits and conditions of safe operation,

This is done with respect to optimal and effective spending of financial resources.

The main goal of maintenance is to ensure required availability of the plant technological equipment, timely removal of defects, their documenting and performance monitoring.

The equipment maintenance is carried out in accordance with the elaborated maintenance program for individual equipment including also the preventive maintenance program. The maintenance method and scope depend on the required safety and reliability of the equipment.

The maintenance in the Dukovany NPP is planned materially and financially from long-term (5 years) to daily maintenance plan.

***Inspections and tests in the Dukovany NPP***

During the operation of the units and during regular reloading outages, the Dukovany NPP operating personnel performs regular tests of the equipment. Extent of the tests and their periodicity is given by the Limits and Condition 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 and procedures are prepared, to which the operating personnel strictly adheres. According the test character, these tests are carried out either by the 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 regulations of the plant. Those are formulated so that 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 a responsible manager.

***Independent monitoring and evaluation of tests and inspections in the Temelín NPP***

Fulfillment and observance of requirements prescribed in the document Limits and Conditions (PP 1,2TL001) approved by SÚJB has in the Temelín NPP one of the highest priorities when assuring safe operation and is also the precondition for the fulfillment of safety analyses prerequisites. Considering that the 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, for independent monitoring and evaluation of the fulfillment of 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 fulfillment of the Limits and Conditions.

For securing the independent monitoring and evaluation of the operational safety of the Temelín NPP, a special control document (PoZJ 27.06.13 – Performance of checks in accordance with L&C and independent monitoring and evaluation of ETE operational safety) is established, the purpose of which is to establish duties and responsibilities for the performance of checks in accordance with the Limits and Conditions and for the performance of internal independent checks of the fulfillment and observance of the limit conditions. Requirement for the performance of internal independent checks of the limits and conditions observance is anchored in the Limits and Conditions document.

The whole process of independent monitoring and evaluation of the Temelín NPP operational safety is divided into several areas:

Fulfillment, spending and violation of L&C

- Internal independent check of the fulfillment and observance of the provisions of the Limits and Conditions
  Internal independent check of the Limits and Conditions observance is being performed by the Department of nuclear and operational safety, the personnel of which perform the control activities of the observance of Limits and Conditions provisions.
- Check of the observance of requirements during the performance of checks in accordance with the Limits and Conditions

In accordance with the Limits and Conditions, the test guarantee, test head, or the reactor unit manager participate in the test performance and evaluation. Representatives of the Department of nuclear and operational safety (or Reactor physics department in case the test is related to safety analyses and the core design) participate regularly on the independent check of the tests and checks in accordance with the Limits and Conditions. This

check is consists in monitoring the observance of performance and evaluation procedure (fulfillment of the criteria of successful tests) of the tests.

When performing checks and tests in accordance with L&C, application of the independent check is secured (three-step check):

Step 1 – Testing manager, reactor unit manager
Step 2 – The guarantee
Step 3 – Nuclear and operational safety department, Reactor Physics department
Procedure for the performance of the required tests and checks in accordance with the Limits and Conditions is described in the Operational procedure 1,2T010 (1,2TC014) – Tests in accordance with the Limits and Conditions. Checks and tests with the frequency 24 hours and less are being performed based on the list of prescribed periodic activities, tests and check with the frequency 7 days and more is performed in accordance with a schedule laid down in advance.

- Check of Limits and Conditions requirements fulfillment during the performance of scheduled putting the equipment into maintenance

  Prior to put the limited equipment into scheduled maintenance, required activities in accordance with Limits and Conditions, related with the putting the equipment out of service, have to be performed.

- Check of Limits and Conditions requirements fulfillment after the maintenance completion

  Prior to put the equipment into operation after the maintenance completion, verification of good operational condition of the equipment and validity check of all influenced requirements for check is to be secured.

- Check of equipment preparedness in accordance with Limits and Conditions
  Equipment preparedness in accordance with the Limits and Conditions on scheduled unit start-up or shut-down is documented by the ”Summary protocol about the Limits and Conditions fulfillment preparedness at start-up and shut-down into the corresponding mode”.

  Internal independent check of the fulfillment of requirements in accordance with the Limits and Conditions

- Check of regulations, procedures and programs, and their changes from the viewpoint of Limits and Conditions requirements fulfillment.

  All operational regulations, procedures and programs must be in accordance with the Limits and Conditions. As to regulations, procedures and programs concerning the limited equipment, the Nuclear and operational safety department is a non-excludable reviewer. Operational documentation is being judged from the viewpoint of the observance of the nuclear and operational safety and their compliance with the approved Limits and Conditions and the unit operational regulations. In case the contents of the documentation, being judged, influences the limited core parameters, or the safety analyzes, also the reactor physics department reviews the operational documentation.
- Assessment of the correctness of the proposed activities, tests, and experiments from the viewpoint of the observance of Limits and Conditions and of the operational safety requirements.

  All activities, tests, and experiments related to the limited equipment, performed on the unit, are performed either in accordance with the corresponding start-up program, operational regulation, or approved operative program. The Nuclear and operational safety department personnel is responsible that there is no contradiction between the proposed activities, tests, and experiments on one hand and requirements of the Limits and Conditions and unit operational procedures on the other hand.

  The Nuclear and operational safety department personnel participate on selected tests ”important form the L&C viewpoint” as independent check and it also performs independent check of the progress of selected transients and observance of approved procedures. Results of these tests together with possible recommendations are listed in the monthly safety reports, which are submitted to the Temelín NPP management.
- Assessment of proposed changes in Limits and Conditions wording.

  Proposed changes of the Limits and Conditions wording must be discussed with all departments affected by the change. The reactor physics department evaluates the proposed change of Limits and Conditions as to conflict with the prerequisites of the safety analyses, core design, and operational core limits. The Nuclear and operational safety department verifies that the proposed change of Limits and Conditions do not conflict with other provisions of Limits and Conditions.
- Investigation of all cases of Limits and Conditions violations, their evaluation and elaboration of measures

against repeated occurrence of their violation.

Upon identification of the Limits and Conditions, it is proceeded in accordance with the control documentation as in case of any failure. In accordance with the corresponding provision of the Limits and Conditions, "Preliminary report about Limits and Conditions violation" is submitted to SÚJB and after the discussion in the Failure commission in presence of SÚJB representatives also the "Report about Limits and Conditions violation".

***Main components lifetime monitoring program***

In the lifetime control process, it is the most important to identify, which degradation mechanisms damages the corresponding area of the material in the decisive way, to create a mathematical description of the material damage process and subsequently the evaluation of material damage trends and thus the determination of the residual lifetime.

In the Dukovany NPP, diagnostic software DIALIFE is created, performing the calculation of the equipment residual lifetime using verified calculation programs based on information from the technological information systems {production units, diagnostics, chemistry, special measurements, SCORPIO system, non-destructive testing results, and material properties database}. In this way lifetime monitoring of the following equipment is performed in the Dukovany NPP:

- Steam generator
- Pressurizer
- Main coolant pump
- Main (coolant) circulation pipeline
- Evaluation of fatigue damage of the reactor pressure vessel.

For the monitoring in DIALIFE pipes of safety class 1 and 2, including the compensation pipe, are prepared.

Great attention is paid to the radiation embrittlement of the reactor pressure vessel. The applied program "Complementary testimony program project" removes, among others, the inaccuracies of the descending reduction and interpretation of data about neutron fluence, and enables to monitor the lifetime during the whole reactor pressure vessel lifetime in accordance with the legislation and international standards.

Erosion/corrosion of piping systems made of carbon steel is monitored in the Dukovany NPP by the CHECKWORKS programs on following systems:

- feed water to steam generator
- live steam
- aftercooling
- feeding tank emptying into condenser
- condensate to feeding tank
- pipe 6,7 and 8 of the turboset extraction
- heating steam condensate from the high-pressure re-heater
- condensate pumps discharge pipe to low-pressure re-heaters 1,2,3,4,5

### 14.1.4 Intervention procedures for the anticipated operational events and accidents

***Dukovany NPP***

Activities carried out by the shift personnel and the unit control room personnel are established in the operating procedures. For the case of extraordinary situation the "Extraordinary situations Elimination" [14-3] document is elaborated. This procedure establishes activities of the operating and main control room personnel for the resolution of failures or abnormal or extraordinary conditions.

New Operating Procedure for Liquidation of extraordinary events [14-4] was put in force on 1st October 1999. This procedure is symptom-oriented and was prepared in accordance with the Westinghouse method and in co-operation with this company. General guidelines of the Westinghouse Company started to be created upon the US regulatory bodies after the Three Mile Island accident and are permanently amended and detailed. A special study confirmed that the Westinghouse procedures are applicable to nuclear power plants with VVER reactors without any significant changes of technology or instrumentation. The only addition was a set of recommendations prepared by the experts, which facilitates application of the individual parts of the procedure. A major part of these recommendations is identical with the PSA study conclusions, conclusions of OSART, ASSET and other international missions as well as with the SÚJB recommendations. The proper Operational Emergency Procedure is composed of 45 individual procedures. New Procedure deals with an extraordinary

event according to its symptoms, i.e. independent on events themselves. Monitoring of the critical safety functions is an integral part of the new Procedure. Compared with the preceding Procedure, the new one covers a significantly wider range of extraordinary states. All extraordinary states are always resolved till the so-called safe condition. This means into the condition when a nuclear unit is fully under the operator's control, and is mostly cooled down to the primary circuit temperature less than 100°C in accordance with the operating procedure. The whole Procedure is written in a two column format, using successive steps method. The left hand column contains the anticipated course or anticipated response of an equipment, the right hand one or several alternative solutions. Each procedure is supplemented with the necessary appendices and graphs. The procedure has the same look and format as other Dukovany NPP documentation.

The Procedure was developed by experts with many years of operating practice. Individual stages of the new operational Procedure development were subjected to verification by both Westinghouse and units control rooms personnel. A study of the human factor response in the application of the Procedure has been performed. The Procedure was validated on the full scope simulator in Trnava (Slovak Republic) and on the multifunction simulator in the Dukovany NPP. The validation results were included into the Procedure's final version.

The Operating Procedure for Extraordinary events liquidation (EOPs) is updated using comments arising during regular training and especially - within the long-term Westinghouse contract, the so-called Maintenance program. Annual meetings of the Procedure authors will serve to discuss all significant changes in the technology of the Dukovany NPP and the consequent necessary changes in the Operating Procedure. At the same time, Westinghouse will acquaint Dukovany personnel with the yearly revisions of the general guidelines to enable the authors to work them into the Dukovany NPP procedures.

The whole development of the new Procedures has been documented, as well as all changes and comments made in the course of verification, validation and training.

Extensive annexed documentation "Background" forms an integral part of the operational procedure for the Extraordinary events liquidation. This documentation includes two basic parts:

- first - which includes brief descriptions of the partial procedure purpose, explanation of the particular extraordinary condition first without operator intervention and then with corrective operator interventions. It also summarizes the strategy of basic operator's interventions and briefly explains them,
- second, more comprehensive part, includes a detailed explanation of each partial step of the Procedure, of each warning and note, including instrumentation and controls involved. The description comprises a separate chapter with all values of the parameters used. Each used value is supported by a computation or by a reference to the plant design documentation.

The Procedure is 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.

Implementation of the Operating procedure for the Extraordinary events elimination induced the necessity to revise the currently valid Instruction for failure states. New procedure for Extraordinary events liquidation valid from the year 1999 was so created.

Since 1994, all Dukovany NPP operating documentation undergoes an extensive reworking. Operating Procedures are divided into two parts: operating - used by operators in the process control, and descriptions - used principally for the training purposes which, besides a detailed description of the equipment, contain description of the operating states, design values and other necessary data. All new documents are formally unified. Databases of signals, protections and blocks, valves, drives, etc. are being loaded in parallel with the documents revision. New system of the databases provides for a better updating of the documents and is an important initial step for the preparation of the plant extensive modernization.

Training of the control room operators is carried out as two exercises with duration of a week in the Dukovany NPP simulator. The training plan is updated once per year in accordance with the operating requirements, so that in a three years cycle each control room operating team goes through all serious and anticipated accidents.

In the present time regulations are being created for the Extraordinary states liquidation for the shutdown reactor (Shutdown procedure) and for the resolution of sever accidents (Severe Accident Management Guidelines), both of them in cooperation with the Westinghouse Company. All these regulations will be linked in one philosophy and will provide for defense in depth in the second through fourth degree in accordance with the INSAG 10 material, issued by the IAEA.

***Temelín NPP***

For the support of the MCR operational personnel during the control of situations under emergency conditions, symptom-oriented operational procedures (EOP) were prepared. Either the reactor trip or start of the safety systems is initiation event for the start of the activities in accordance with these regulations.

EOPs are divided into two parts, included in independent regulations TCD 07 [14-5] and TCD 08 [14-6] representing the System oriented regulations package. This package includes two independent but linked procedures categories forming a systematic tool for a permanent monitoring of the safety during emergency conditions.

TCD 07 includes procedures named Procedures for optimal safe condition restoration. These regulations are based on symptom-oriented strategies, which were developed for different types of emergency situations. The term ”optimal” relates with the ability to recognize the accident type and to decide the optimal procedure and interventions of the MCR operational personnel with the aim to restore the safe condition of the unit.

In these cases, where expected optimal activities do not lead to any satisfactory solution, or when some of the so-called critical safety functions are jeopardized during the intervention, the MCR operative personnel pursues its activities in accordance with the second group of procedures. These ones are called Procedures for restoration of critical safety functions. They are based, similarly as the previous ones, on symptom and function oriented strategies, which are independent on initiation events and the progress of the event. The procedures are directed to the restoration of the following critical safety functions of the unit.

- core subcriticality
- core cooling
- primary circuit heat removal
- primary circuit integrity
- containment integrity
- coolant reserve

The name of the systematic tool securing a permanent evaluation of critical safety functions during the solution of emergency conditions is ”Critical safety functions trees”, which, in case jeopardy of any of the critical safety function occurs, will lead the user directly to the particular procedure for the restoration of the given function.

The package of the symptom oriented operational procedures of the Temelín NPP was elaborated in accordance with the methodology, prepared by the Westinghouse Owner Group. The package of the 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 level 1 PSA study of the Temelín, all relevant scenarios, which might lead to the core damage. The MCR operative personnel interventions are always in accordance with the requirements for the minimization of consequences of the of a possible radioactivity release to environment.

All unit regulations of the Temelín NPP (for normal, abnormal and emergency situations) were elaborated in a unique way for their preparation and maintenance, consisting in several preparative phases, which are fulfilled prior issuing the authorization with their use in the plant operation. The goal of these phases is to secure the confidence in the correctness and completeness of the included information (both from the procedures authors and procedure users viewpoint). The above-mentioned phases are as follows:

1) Preparation of the first procedure proposal based on available input information,
2) Verification of the compliance of the prepared procedures with the design and other documentation,
3) Verification of the feasibility of the proposed operational personnel interventions in the individual procedures,
4) Operational personnel training in the use of the regulations,
5) Feedback as the result of findings from the use of these regulations in operation.

The first version of symptom-oriented emergency regulations was prepared in cooperation with the Westinghouse Company, and the first phase of the regulations preparation was finished by their issue in the Czech language for review (description and the manipulation part). During the next phase their correctness from the material point of view and for accuracy, and for accordance with the design and other documentation was verified. During this phase, information was gathered about the design status, usability of the described strategies, comments from independent experts, etc. Independent verification analyses, which had confirmed the correctness of the proposed strategies, were part of the above verification process. All information resulting from the verification was documented in a uniform database and used for the issue of a new revision of the regulations.

Verification of the correctness and possibilities concerning the expected interventions of the operational personnel, and availability of means mentioned in the procedures, necessary for the performance of interventions, was performed on the full scope simulator in the Temelín NPP in presence of plant workers. Relevant scenarios were created for the needs of this validation process. Similarly as in the pervious case, all gathered information was documented and, after revision, used in the further revision of the procedures.

For operative personnel of the main control room, the simulator training is the necessary condition for obtaining the required authorization (license). The training includes the simulation of different unit operating modes – ranging from normal over abnormal to emergency conditions. During the trial use of EOP for emergency conditions, the whole main control room personnel undergo a training program on the full scope simulator. Training for the use of symptom oriented EOP mostly includes simulation of unit conditions and states, which cannot be verified during the normal unit operation.

Philosophy of using these emergency procedures requires to follow the requirements of the individual steps, it does not, nevertheless, require its detailed knowledge. Understanding of fundamental strategies used in the emergency accident modes and obtaining the basic routine resulting from the EOP use, rules are therefore emphasized. In particular those scenarios requiring timely and correct operator interventions, and correct communication and coordination of the shift personnel during the use of the symptom oriented EOP package are emphasized.

Information, newly obtained during the basic and repeated operator training, is used for the preparation of next revisions of the symptom oriented EOPs. These revisions will be issued during the Temelín NPP operation.

### 14.1.5 Engineering and technical support

Within the Dukovany NPP organizational structure, there is an Engineering Center. This center is aimed to:

- support operating departments in ensuring technical level and reliability of the process equipment based on the current design,
- establish new requirements for technical level, reliability, and safety of the equipment resulting from new scientific and technical achievements, requirements of State regulatory bodies, and international recommendations.

The technical support is provided by highly educated personnel, qualified for the specific tasks they perform themselves, or which are performed under their supervision.

The Dukovany NPP technical policy is discussed in the Evaluative Technical Committee.

Further the NPP takes profit from external technical support provided by the services of research institutes, specialized departments of universities, and some suppliers of engineering services. Nuclear Research Institute Řež contributes in a significant way to this technical support.

Technical support functions concerning the safe operation of the Temelín NPP are carried out by different departments of several sections. The responsibilities and rights are clearly established in documents on company level and in organizational documents of the power plant [14-7]. Close working relationships exist between the technical support groups and operation and maintenance departments. The assigned suppliers are closely linked with the modifications implementation system. The modification system is controlled by the Engineering department. It is part of the current commissioning organization, where many modifications are implemented in common effort of the plant and the suppliers. Regarding the influence on the plant safety, three modification categories are defined. Modifications, having influence on the plant safety, or modifications changing certain FSAR prerequisites, must be approved by SÚJB prior their implementation. Responsibilities of the NPP departments in the process of their evaluation are established in the QA documentation [9-5]. All modification requests are reviewed and evaluated by the plant departments. Responsibilities of the suppliers in the implementation process of the modifications are established in the corresponding contracts. The plant has established a system of supplier inspections during the modifications implementation.

### 14.1.6 Operational events experience exploiting

Since the beginning of its commercial operation in 1985, nuclear power plant Dukovany applies the system permitting to benefit from its own operating experience. Since 1991 also experience from power plants outside the Czech Republic, obtained from the WANO network, is used. The whole process, which includes examination of the operational events causes, remedial measures and feedback, is described in a special instruction.

In the above regulation, criteria are given for recording the events; for safety related events the instruction also provides criteria in accordance with which an event is reported to the SÚJB or other relevant bodies or organizations (ČEZ, a.s. headquarters, fire brigade, etc.). The events are evaluated according to the INES international scale. A special department of the Nuclear Safety section - events investigation - is responsible for the event-related investigation, it also co-ordinates the whole process of events investigation in the plant, but also other further plant specialists from special departments are involved in the process.

For regular evaluation of effective ness of experience from own operational events, self-evaluation principles are used. Main criterion for correctly identified causes and correct proposal of corrective measures is the fact that no events repeat for the same causes. Repeated events or problems are regularly evaluated in quarterly or annual reports of the feedback department and possible further measures are proposed. For tracking problematic areas – trends, precursors – it uses coding of events causes. Self-assessment based on the ASSET methodology for the identification of the main safety issues of the power plant is elaborated once per two years as Attachment to the annual report "Feedback from internal events".

***Operational events in the Dukovany NPP***

Three types of events are distinguished in the monitoring system (process):

1) Safety relevant events (INES classification more or equal 0). These events must be discussed by the Failure Commission of the Dukovany NPP and the causes together with the adopted corrective measures are regularly checked out by SÚJB.
2) Minor events (INES classification less than 0, they are classified out of scale). These events are investigated within the work order of the corresponding departments; corrective measures are checked by the feedback department, these are ”low level” events.
3) Events without consequences - ”near misses” (INES classification less than 0, they are classified out of scale). These events are treated in the same way as the ”low level” events. Their possible influence on any process in the plant is being evaluated.

The Events Investigation Commission confirms at its regular meetings the completeness of the investigations of safety related events causes (0 or higher on INES scale) and adopts measures for the elimination of their causes.

Significant events are discussed also by Technical and Safety Commission in presence of plant top management.

The corrective measures are filed in a special program, and personnel of the nuclear safety department checks their implementation by the established deadline.

After the process of investigation is completed, characteristic data of that event are coded into a database being part of the plant computer network. This makes all important data and experience available and usable to improve the plant operation reliability. The database contains operational events data since 1985.

Selected events having occurred in the plant and abroad are included in the training of the plant personnel and management.

SÚJB takes part in the supervision of this process in accordance with the law.

***External events***

System of taking profit from the events in other nuclear facilities is incorporated into Events investigation department. 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 Dukovany NPP practice. Information selected from WANO, INPO and IAEA sources is included into agenda of the Events Investigation Committee. All obtained information is archived in form of a database, for which the software support is available, and used by the plant experts as technical support in resolving plant’s problems. The system is described in a special instruction and comprises five basic program:

- Operational events reports,
- Direct information exchange between the operators,
- Operational indicators WANO, PRIS,
- Good practice,
- Partner inspections.

***Temelín NPP***

Operational events feedback group is incorporated in the Nuclear safety department and is formed of 4 persons, coordinating the feedback activities program both for internal and external events. The NPP uses a system for annunciation and investigation of internal events.

The threshold for inclusion of an event into the annunciation system is very low and includes events of types ”near misses” and ”precursor”. Initiation events are incorporated in three groups based on their significance for the nuclear safety. Availability of operational on-line data helps to the feedback group to gather data and subsequently to analyze the events. Three engineers and one coordinator are trained in using the methods for evaluation of root causes.

The most important events are assessed by Reviewing commission, approving root causes of the events and corrective measures. This commission is formed of power plant management and directors of QA and feedback departments.

In the Temelín NPP, program for utilizing the external events was also established. Selected external events are sent to the pertinent experts for review. Corrective measures, they propose, are assessed from the viewpoint of possible use in the Temelín NPP. The records provide the necessary documentation and it is possible to use them without problems.

### 14.1.7 Notification of events important for nuclear safety

Article 17, para 1, letter c) of the Atomic Act establishes following obligations for the authorization holder:

”*To comply with the conditions of the authorization issued by the SÚJB, to proceed in accordance with approved documentation and investigate, without delay, any breach of such conditions or procedures and take remedial measures and measures to prevent repetition of such situations. Any case when exposure limits or limits for safe operation of a nuclear facility have been exceeded or violated shall be reported to SÚJB without delay*”

Reports of important events to the Regulatory Body is thus one of the basic obligations of a nuclear installation operator. Such information transfer comprises non-nominal states, in relation to nuclear safety and radiation protection, emergency situations and also activities affecting nuclear safety and radiation protection. The reporting procedures are described in the plant internal documents. The principal document establishing both the obligation and method of communication with the Regulatory Body is the system standard ”Nuclear Safety Rules”. The linked-up guidelines give details for the contact with SÚJB, precise the frequency of information transfer, manner of transfer and departments responsible for the preparation of the information to be transferred.

The Regulatory Body is informed daily, during regular meetings held on working days. For the reporting of operational states both power plants established a special log of operative contact between the operator and local safety inspectors. To get acquainted with the activities, the inspectors have a right of access to the computer network enabling them to monitor activities planned for each particular day.

### 14.1.8 Optimization of nuclear facility operational radioactive waste production

***Basic objective***

The basic objective of radioactive waste management is their isolation from the environment.

***Radioactive waste (RaO) handling system***

Radioactive wastes from normal operation of the Dukovany NPP, with exception of highly active wastes (spent fuel, components of reactor internals), stored, after the appropriate treatment, within the plant site. With respect to the ecological and economic conditions of the Dukovany NPP, radioactive waste storage in this storage facility represents an optimal option fulfilling the basic objective - its isolation from the environment, until its radioactivity is significantly reduced as a result of decay. Storage in the storage facility is conditioned by the processing the wastes into a form suitable for storage.

Liquid RaOs are temporarily stored as liquid concentrate after sedimentation and concentrating. Subsequently, they are processed in a bitumen product. Considering the plant produces RaO since 1985 and the bitumenation line started to treat the concentrates only in 1994, the line works in permanent operation. Each year the volume of stored RaOs is decreased by about 300 $m^3$, as the production of new wastes is the half of the bitumenation line capacity. Thus the quantity of stored liquid radioactive wastes permanently decreases.

Solid RaOs, after sorting out non-active components, and final sort according the type, are compressed. Stored low-pressure compressed RaOs in barrels are periodically (once per 10 years) treated using high-pressure press and stored in permanent repository. This repository, which was originally a property of ČEZ, a.s., is now a state property and is operated by the Radioactive Waste Repository Authority (SÚRAO-”RAWRA”).

Radioactive wastes with very small volume (such as ion exchangers - ”resins”) are, for the time being, only collected and stored. The plant has available sufficient storing area for this storage.

***Minimization principle***

An important principle of the radioactive waste management is the minimization of their amount. Minimization is a process, leading to a minimum possible volume of processed wastes to be stored in the storage facility. This process begins with the technological equipment and their modifications, continues in the operating procedures and their observance and ends at the reduction factor characterizing the treatment and actual configuration of stored barrels (space utilization). Minimization may be also understood as an effort to reduce, as much as possible, the stored waste mass. Reduction of waste volumes brings ecological and economic benefits. In the present time the production of radioactive ion-exchangers significantly decreased.

At Dukovany NPP, currently implemented methods are aimed at further reduction of the radioactive waste generation:

- development and implementation of low-waste decontamination technologies, in particular for metals with emphasis on the limitation of the amount of salts (water is recycled),
- separation of sediments from the exchanger prior their mixing with radioactive waters,
- limitation of unnecessary decontamination works based on qualified estimates,
- limiting number of unnecessary objects brought into the controlled area,
- limiting unnecessary entries of persons,
- use of thinner (lighter) foils as protection against contamination,
- using optimal concentrations of drained media,
- replacement of service water with condensate or demineralized water in points, where leakage occur (reduction of salts amount in radioactive concentrates).

Nuclear power plant Dukovany categorizes its technological wastes as follows:

| No. | Category | Waste characteristics | Source |
|---|---|---|---|
| 1 | pressable-combustible | discarded personal protection aids, decontamination and cleaning cloth, packaging materials, paper, PE sheets | major part of this waste is produced during revisions and repairs of the unit |
| 2 | Non-combustible | glass, wire, tins, cuttings, ceramics, filters | mostly during revisions and repairs |
| 3 | Wood | wooden transport crates, pallets, scaffolding floors | Incidental, especially during replacement of air-conditioning filters |
| 4 | Burnable- unsuitable for combustion | PVC, PTFE (teflon) - sheets, sealing materials | Materials formerly much in use within controlled area |
| 5 | Bulky metal objects | structure materials made of carbon or stainless steel | major reconstructions |
| 6 | Ion exchangers | discarded cartridges of purifying stations | regular replacement of materials, incidental leaks during technological operations |
| 7 | Other sorbents | activator charcoal, vapex, zeolites | regular replacement of materials, incidental leaks during technological operations |
| 8 | Sludges | sediments in tanks, mixture of organic and inorganic matter of non-standard composition | rinsing and cleaning of floors, dust produced at materials cutting and abrasing, non-design crystallization |
| 9 | Waste water | as a rule, diluted solutions of inorganic compounds with impurities | uncontrolled leakages, fore-runs, sampling, laboratory water |
| 10 | Oils and solvents | deteriorated lubricants, remnants of solvents and scintillers | replacement of laboratory cartridges, discarding of unusable and contaminated liquids |
| 11 | Gases | air-mixture containing radioactive aerosols and gases | releases from equipment conditioned radioactive fluids |

These radioactive wastes are disposed as follows:

| No | Category | Main technology of treatment |
|---|---|---|
| 1 | Pressable-combustible | high-pressure compacting |
| 2 | Non-combustible | high-pressure compacting |
| 3 | Wood | high-pressure compacting |
| 4 | Burnable- unsuitable for combustion | high-pressure compacting |
| 5 | Bulky metal objects | disposal at storage facility without preceding decontamination and recycling |
| 6 | Ion exchangers | safe storage |
| 7 | Other sorbents | safe storage |
| 8 | Sludges | safe storage |
| 9 | Waste water | bitumination of concentrates |
| 10 | Oils and solvents | combustion |
| 11 | Gases | filtering |

***Spent nuclear fuel***

Spent nuclear fuel is stored for 5 years in the storage pool. Subsequently it is transferred into Castor 440/84 containers. Each container contains a maximum of 84 spent fuel assemblies. Containers are stored in the Intermediate Spent Fuel Storage Facility with the current capacity of 60 containers. Currently, storage capacity extension is in progress to achieve the total of 193 Castor 440/84 containers. Such capacity is necessary for the Dukovany NPP operation till the year 2025.

***Radioactive waste storage facility***

The Regional Radioactive Waste Storage facility at Dukovany site is designed to allow disposal of the processed low-level and medium-level short-lived radioactive wastes from Czech nuclear power plants. Waste is stored in a solid, stabilized form, isolated from the environment and in accordance with the approved Limits and Conditions. As already mentioned above, the repository is currently under the property of the state. Its important capacity allows the storage of all RaOs produced in both NPPs in the Czech Republic.

## 14.2 Statement on implementation of the obligation concerning Article 19

The above text proves that the legislative requirements imposed on the commissioning of a nuclear installation, its operation and performance of the proper activities are conform to the requirements of Article 19 of the Convention.