NATIONAL REPORT OF THE SLOVAK REPUBLIC

COMPILED IN TERMS OF THE CONVENTION ON NUCLEAR SAFETY

SEPTEMBER 2001

CONTENTS

Abbreviations used

AKOBOJE	Automated complex of nuclear power plant security protection
ALARA	As Low As Reasonably Achievable
BDBA	Beyond Design Basis Accident
BSC	Bohunice Processing Center
ERC	ÚJD´s Crisis and Coordination Center
CDF	Core damage frequency
CDE	Collective Dose Equivalent
CP	Civil protection
CR	Current repair
CPA	Slovak Ministry of Interior - Civil Protection Authority
ČSSR	Czechoslovak Socialist Republic
ČSFR	Czech and Slovak Federal Republic
ČSKAE	Czechoslovak Atomic Energy Commission
DBA	Design Basis Accident
DG	Diesel generator
EdF	Electricité de France
ESFAS	Engineering Safety Features Actuation System
EOP	Emergency Operating Procedures
ECC	Emergency Control Center
EOH	Extended overhaul
ERO	Emergency Response Organization
FCC	Fiber-concrete container
IAEA	International Atomic Energy Agency
ICRP	International Commission for Radiation Protection
IDE	Individual Dose Equivalent
INES	International Nuclear Events Scale
I&C	Instrumentation and control system
INSAG	International Nuclear Safety Advisory Group
ISFSF	Interim Spent Fuel Storage Facility
KRH	Slovak Government’s Commission for Radiation Accidents
KKRH	Regional Commission for Radiation Accidents

L&C	Operation limits and conditions
LBB	Leak Before Break
LOCA	Loss of Coolant Accident
MGU	Main Generating Unit
MO-ASR	Ministry of Defense – Army of the Slovak Republic
MŽP SR	Ministry of Environment of the Slovak Republic
MSK –64	Medvedev Sponhauer Karnik scale for the evaluation of seismic events
MZ SR	Ministry of Health of the Slovak Republic
NPP	Nuclear Power Plant
NPP A-1	Nuclear Power Plant Bohunice A-1
NPP V-1	Nuclear Power Plants V-1 Jaslovské Bohunice (units 1 and 2)
NPP V-2	Nuclear Power Plants V-2 Jaslovské Bohunice (units 3 and 4)
NPP Mochovce	Nuclear Power Plants Mochovce
NI / NPGI	Nuclear installation / nuclear power generating installation
NUSS	Nuclear Safety Standards
OCG	Operative-Control Group
OH	Overhaul
NIE/OE	Event at nuclear installation / operating event
OKRH	District Commission for Radiation Accidents
PA	Operating assembly
PHARE	EU initiative for economic integration of Central and Eastern European countries
PC	Primary circuit
POSAR	Pre-operation Safety Analysis Report
PSA	Probabilistic Safety Assessment
QA	Quality assurance
RAW	Radioactive wastes
RC	Reactor core
RÚ RAW	National RAW Repository
SAMG	Severe Accident Management Guidelines
SAR	Safety analysis report
SBEOP	Symptoms-based Emergency Operating Procedures
SE, a.s.	Slovenské elektrárne, Joint Stock Company
SE-EBO	Nuclear Power Plants Jaslovské Bohunice, branch plant of SE, a.s.

SE-EMO	Nuclear Power Plants Mochovce, branch plant of SE, a.s.
SE-VYZ	NPGI Decommissioning and RAW and Spent Fuel Treatment , branch plant of SE, a.s.
SG	Steam generator
SHMU	Slovak Institute of Hydrometeorology
SIRM	Safety Improvement of Mochovce NPP Project Review Mission – conclusions of the IAEA June 1994 Mission to Mochovce
QS	Quality System
SPSA	Low-power and shutdown PSA
SSV	Feedback group
SÚRMS	Slovak Radiation Network Monitoring Center
STN	Slovak Technical Standard
SNIDF	State Fund for the Decommissioning of Nuclear Power Generating Facilities and for Spent Fuel and Radioactive Wastes Treatment
SHI	State Health Institute
TSMS	Technical Safety Measure Specification
ÚJD	Nuclear Regulatory Authority of the Slovak Republic
US NRC	United States Nuclear Regulatory Commission
VÚJE	Nuclear Power Plant Research Institute, Trnava a.s.
WANO	World Association of Nuclear Operators

Reference index

Convention on Nuclear Safety (article)	**National Report** (chapter)
article 6	chapter 2
article 7	chapter 3
article 8	chapter 3.1.3
article 9	chapter 3.2
article 10	chapter 4.1
article 11	chapter 4.2
article 12	chapter 4.3
article 13	chapter 4.4
article 14	chapter 4.5
article 15	chapter 4.6
article 16	chapter 4.7
article 17	chapter 5.1
article 18	chapter 5.2
article 19	chapter 5.3
Planned safety improvement-related activities	5.4
List of nuclear installations and technical and economical parameters	annex 6. 1
Selected generally binding legal regulations	annex 6.2
List of national and international documents	annex 6.3

1. Introduction

1.1 Purpose of the Report

As the first country with a nuclear installation in terms of the Convention, the Slovak Republic ratified on 23 February 1995 the Nuclear Safety Convention (hereinafter the Convention). In undertaking this step, the Slovak Republic declared its willingness and readiness to actively participate in the honoring of the Convention provisions. The National Report presented has been compiled in terms of article 5, and its structure respects the Guidelines Regarding National Report . Slovakia presented its first Report in September 1998; it contained an account of the fulfillment of the Convention as of 1 July, 1998. The present, second National Report contains an account of the fulfillment of the Convention provisions for the period between 1 July 1998 and 1 July 2001. Consequently, the two documents (both the first and the second National Report) have to be viewed as an integral whole, along with the document entitled Answers and Questions of April 1999.

For the list of nuclear installations in terms of article 2 of the Convention, see Annex No. 6.1.

1.2 The concept of the utilization of nuclear sources in Slovakia

To a significant extent, Slovakia remains dependent on imports of primary energy sources, these imports representing as much as 80% of the needs. The most important positions of imports of the primary energy sources include crude oil, gas and nuclear fuels from the Russian Federation.

Being a significant source of Slovakia's grid, nuclear power plants make a significant contribution towards the coverage of the overall consumption of electricity in the Slovak Republic: compared to 1999 when NPPs´ share on overall production in Slovakia made up 47%, the share is expected to grow to approximately 55% within the years 2000-2003. Dominant producer of electricity in Slovakia is SE a.s.. Figure 1.1.1. illustrates the shares of the sources on power generation in 1999 and 2000, and Figure 1.1.2. shows the development of the consumption and the structure of production over the recent ten years.

Fig. 1.1.1 Shares of sources on power generation in the Slovak Republic

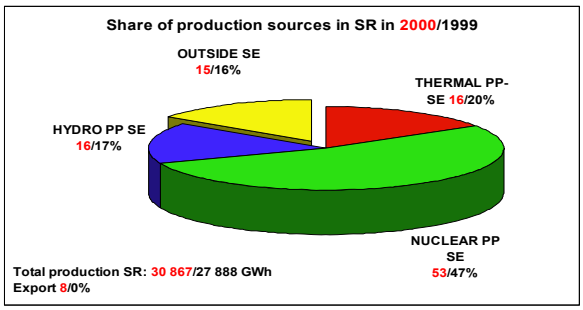
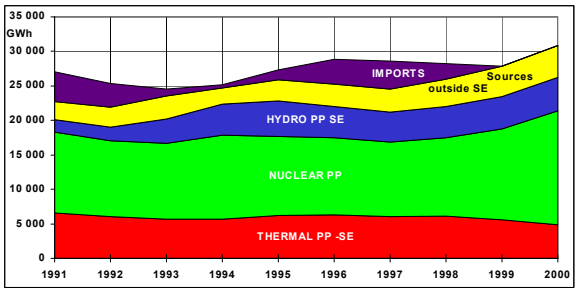


Fig. 1.1.2 Development of consumption and production structure in the Slovak Republic



For the time being, Slovakia operates 6 units with WWER-440 nuclear reactors, as well as additional nuclear installations at Jaslovské Bohunice and Mochovce sites.

In January 2000, the Slovak Government approved the main pillars of Slovakia's energy policy:

I. preparation for the integration into the European Union's internal market,

II. security of energy supplies,

III. sustainable development.

Accounting for and based on them, short-term, medium-term and strategic goals of energy policy of the Slovak Republic were formulated. The following goals are relevant with respect to the future utilization of nuclear energy in Slovakia:

1. short-term goals:

- modernization and safety improvement of NPP V-2 at Jaslovské Bohunice,
- development of the concept for economic, material and time schedules of spent nuclear fuel treatment and of the time schedule of decommissioning of nuclear installations,
- submission of the solution for the possible completion of units 3 and 4 of NPP Mochovce

2. medium-term goals:

- implementation of the nuclear safety improvement programme at NPP V-2 - implementation of the list of measures oriented towards the achievement of the safety standard in compliance with ÚJD and IAEA requirements.

3. strategic goals:

- fulfillment of international agreements in the area of the environment, nuclear safety, investments and trade in the energy sector (the Kyoto Protocol, Convention on Nuclear Safety, Convention on the Energy Charter, Protocol of the Energy Charter on Energy Efficiency, etc.)
- finalization of the fuel cycle back end concept.

Annex No. 4 to Energy Policy shows objectives key with respect to the nuclear energy system:

- completion of the construction of investments under construction: unit 2 of NPP Mochovce,
- implementation of the gradual upgrades of safety and reliability of NPP V-1 and V-2 with a positive impact on the economy of the entire power grid (note: the NPP V-1 upgrading project was completed in 2000),
- implementation of the lifetime extension and upgrading of NPP V-2 provided that such extension is efficient and effective.

Along the lines of Slovak Government's resolution No. 302 of 21 April 1999, the Slovak Government (see paragraph A.1) acknowledged the report on the progress of works on gradual upgrading of NPP V-1, justification for continuing operation thereof, and cancelled Government's Resolution No. 466/1994 on shut-down of NPP V-1 in 2000 at the latest. Also, the government instructed Minister of Economy to ensure accomplishing of the gradual upgrading of NPP V-1 by the end of 2000; and ÚJD Chairman to conduct, in cooperation with IAEA, safety reviews (see paragraph 2.1.). Gradual upgrading was completed in June 2000.

The Agenda 2000 – Commission´s opinion on Slovakia´s Application for the Membership of the European Union in its part Energy concludes:

„...No major difficulties are foreseen for compliance with Euratom provisions. Nuclear safety requires continued particular attention. Safety standards should be tackled appropriately and realistic programmes implemented quickly. Longer term solutions for waste need attention."

The Accession Partnership has identified for the energy sector the following medium term priority " Energy: implementing a comprehensive long term energy strategy based on efficiency and diversification which foresees the alignment to and implementation of EC energy legislation, the completion of Mochovce nuclear power station according to internationally agreed safety principles, and implementation of a realistic programme for the closure of the Bohunice plant."

The High-Level Work Group (HLWG) of the EU and Slovak Republic established, on 1 June 1999, a Joint Task Force on Nuclear Energy that analyzed the impacts of five different alternatives of the shut-down of the NPP V-1 between 2003 and 2014. Based on background documents prepared by the Task Force mentioned, HLWG adopted a joint position on the acceptability of the realistic date of the shut-down of NPP V-1 in 2006 and 2008 respectively. In its resolution No. 801/1999 of 14 September 1999, the Slovak Government approved the said date. On 29 November 2000, the Slovak Government reviewed the draft procedure of the shut-down of NPP V-1 at Jaslovské Bohunice, including the solution to social and economic impacts thereof, and adopted Resolution No. 974/2000.

The objectives of the energy policy included the commissioning of units 1 and 2 of NPP Mochovce. After a successful trial operation, unit 1 started full operation on 29 January 1999. Physical start-up of unit 2 of NPP Mochovce commenced on 5 October 1999 by loading the reactor with fuel, and criticality was reached on 1 December. The approval for permanent operation has been issued by UJD on 11 April 2000.

By its Resolution No. 257/2000 of 19 April 2000, the Slovak Government did not suspended the completion of the construction of NPP Mochovce units 3 and 4; rather it decided to abstain from granting sovereign guarantees for loans to be used to finance the completion. In this way, the option of NPP

Mochovce 3 and 4 being completed by foreign investors and/or foreign investors participating in the power energy privatization process through investments into units under construction has not been ruled out, and SE, a.s. was given the opportunity to officially negotiate with potential investors.

In this connection, SE, a.s.´s Board decided to establish a new branch plant of SE termed Mochovce Units 3 and 4 (acronym SE-MO34). This branch plant was established as of 1 July 2001 through splitting off from SE-EMO. The reason for the establishment of this branch was to distinguish the cost for the energy production on units 1 and 2 from the costs connected with the possible completion of units 3 and 4. The scope of SE-MO34´s activities includes activities such as administration and conservation of units 3 and 4 of the NPP Mochovce and administration and maintenance of equipment for construction. Proposals for future technical level of units 3 and 4 has been developed in accordance with the IAEA recommendations for delayed nuclear power projects in a manner to fulfill in a maximum extent the assumed development in nuclear safety.

By its Resolution No. 5/2001, the Slovak Government acknowledged the Draft Concept of the Economic, Material and Time Schedule of Spent Nuclear Fuel Management (SNF) and of Decommissioning Procedures of Nuclear Power Generating Installations.

Among others, the recommendations of the draft include:

- to store Bohunice SNF at the upgraded ISFSF Bohunice - through 2047,
- to select storage technology for long-term storage of SNF at the Mochovce site – by 2002,
- to construct ISFSF Mochovce – by 2006,
- to continue the development of the underground repository aimed at a high quality preparation for national and regional solution of direct disposal of spent nuclear fuel – by 2037,
- finalize negotiations concerning SNF reprocessing with return of high-level activity wastes and products of reprocessing.

The NPP A-1 decommissioning plan assumes the completion of stage 1 of decommissioning by 2007 (the stage being characterized by the following major traits: spent fuel transported from the power plant; majority of liquid RAWs adjusted to a form enabling safe final disposal; all remaining RAWs treated to a form enabling their safe permanent disposal or long-term storage; the necessary decontamination of premises and rooms performed to further reduce potential sources of leakage of RA materials), closure of the power plant under supervision for a period of 30 years through 2037 and its decommissioning by 2050.

From among several alternatives, the variant „NPP Decommissioning with Protected Deposition of Containment for 70 – 80 Years and Decommissioning by 2098“ was selected for NPP V-1 and approved by the Government.

The development of the nuclear energy system in the Slovak Republic is in accordance with the above mentioned objectives and goals.

2. Nuclear installations in the Slovak Republic according to the Convention

In terms of article 2 of the Convention, the Joint Stock Company Slovenské elektrárne is the operator of the following nuclear installations, being its branch plants:

- Nuclear Power Plants Bohunice, o.z. - units V-1
- Nuclear Power Plants Bohunice, o.z. - units V-2
- Nuclear Power Plants Mochovce, o.z. – units 1 and 2
- NPGI Decommissioning and RAW and Spent Fuel Treatment, o.z.:
  Interim Spent Fuel Storage Facility (ISFSF)
  Technologies for RAW Processing and Treatment
  National RAW Repository

VÚJE operates, at the Jaslovské Bohunice site, an incinerator of radioactive wastes.

2.1 Nuclear Power Plant Bohunice - Units V-1

2.1.1 Description of NPP V-1 units

See the National Report as of September 1998.

2.1.2 Safety assessment of NPP V-1 units conducted

2.1.2.1 External review missions

Since July 1998, the safety of NPP V-1 units has been subject to review by the following external missions:

- Mission of the World Association of Nuclear Operators - WANO Peer Review to NPP Bohunice V-1 on 19 October – 6 November 1998. International experts identified 14 areas for improvement and also 9 strengths, i.e. areas that may serve as a good practice to other power plants.
- Repeated IAEA Mission – Assessment of seismic data (SIDAM) for the Nuclear Power Plants Bohunice and Mochovce, on 16 November – 20 November 1998. The aim of the mission was to review the method of the evaluation of the seismic input data and evaluation of the safety impacts of external earthquake hazards. The team assessed the background documents presented and compared them with the recommendations of the IAEA safety guideline 50 - SG - S1, related the location of NPPs. Achieved results were concluded as being satisfactory completed.
- Visit of a IAEA expert group to review the preparedness for the Project Y2K (the year 2000), on 26-28 April 1999. The team appreciated the extent and the appropriateness of SE, a.s.´s strategy of the approach to the problem of the year 2000. The team also provided some recommendations and suggestions to improve the Y2K programme, in particular related to the identification of problem areas

and elements, frequencies of monitoring of the progress by the management, system testing, external factors, cooperation with external partners, etc.

- IAEA "Follow-up Review Mission on Seismic Capacity and Upgrading of Bohunice V-1 NPP" took place on 1 - 8 September 1999. The Mission represented a follow-up of the Mission that visited the NPP in July 1994, and assessed the NPP V-1 seismic reinforcement program that had been part of the extensive upgrading program of NPP V-1. The assessment was mainly focused on the documentation related to organization of reinforcement program and to general criteria of seismic resistance as well. The Mission concluded that all measures related to NPP V-1 seismic reinforcement were in accordance with the approaches used by NPPs Paks and Mochovce. This fact confirms the reliability of the entire programme. The facts commented upon by the Mission did not cast any doubts on the overall concept of the improvement programme, and did not introduce any changes into the structural works performed.

  Also, the Mission completed the Technical Guideline Document for seismic evaluation of NPP V-2.

- WENRA Task Force Mission to NPP V-1 took place on 12-15 October 1999 at Jaslovské Bohunice and on 15 October 1999 at ÚJD. The Mission focused on completion of information for the WENRA review report on the status of nuclear safety in countries applying to join the EU, of March 1999, adding information concerning WWER-440/V-230 units. The "Western European Nuclear Regulators` Association Report on Tasks Force Mission to Bohunice and Kozloduj Nuclear Power Plants (February 2000)" stated, a.o., "…significant improvements to reactor safety. A concern remains about the ability of the confinement to cope with the failure of a large primary circuit pipe work. If a solution can be found to this issue, the plant should reach a safety level comparable to that of Western European reactors of the same vintage. "

- IAEA Mission to Review the Results of the Gradual Upgrading at Bohunice WWER-440/230 NPP Units 1 and 2 (20-24 November 2000). The IAEA Mission took place based on ÚJD´s request secondary to Slovak Government's Resolution No. 302/1999 of 21 April 1999. The Mission's objective was to review the outcome of the gradual upgrading (reconstruction), in particular whether the measures taken have been sufficiently oriented towards the relevant areas. Moreover, the mission obtained an overall picture of the safety improvement of the power plant through improving the efficiency of the main safety functions under operating and emergency conditions. The experts also evaluated the improved defense-in-depth concept of the power plant which defines a new safety case. In addition to the evaluation of the gradual upgrading project, the experts also verified the operational safety. In both areas NPP V-1 recorded an appropriate progress, as reflected in the achievement of balanced NPP´s security and safety precautions. In their conclusions, the Mission stated: "…..The programme defines a new safety case (new design basis) which satisfies the Slovak National Requirements and goes in some areas beyond the IAEA recommendations for safety upgrading of WWER440/230 NPPs. ….In conclusion, all safety issues identified earlier by the IAEA have been appropriately addressed. Further work on safety is a continuous process which is needed to maintain a high level of safety. " Also, the Mission made some additional (supplementary) recommendations, such as completion of PSA for low power, accident management and severe accident mitigation programme, that go beyond the original recommendations of IAEA; they however represent recent development trends in the area of nuclear safety.

2.1.2.2 NPP V-1 safety analysis reports

The initial safety analysis report

The initial safety analysis report was drafted in 1978 as a document entitled “NPP V-1 Pre-Operation Safety Report“. Its structure and contents accounted for the requirements of the amended version of the document „Guidelines for the Setting up and Contents of Safety Reports“ issued by ČSKAE in 1977, extended by the following chapters:

- Principal Criteria
- Operation Limits and Conditions for NPP V-1 unit 1.

Later amendments to the initial Pre-Operation Safety Analysis Report

An amendment was made in 1990 to replace the chapter „Safety Analyses“ of the initial report, due to the existence of more modern computer codes and in connection with some changes in „opinions“ concerning approaches to nuclear safety. Within the amendment, chapters were drafted to replace chapter V „Safety Analyses“.

In connection with the „small“ reconstruction of NPP V-1 units in preparation, a solution was adopted according to which no other chapters of the initial 1978 Safety Report were rewritten.

Upgrading of NPP V-1 units (so-called „small reconstruction“) was performed based on ČSKAE decisions Nos. 5/91 and 213/92. As a result of the above mentioned upgrading, some chapters concerning safety analyses of the NPP V-1 Safety Report issued in 1990 had to be amended. This amendment to the chapter „Safety Analyses“ was done by VÚJE in 1993.

A safety analysis report for gradual upgrading of NPP Bohunice V-1 has been placed in 1993.

Safety Analysis Report after the gradual upgrading

Within the project preparations for the gradual upgrading of NPP V-1, the extent of the amendment to the Safety Report due to the extent of the gradual upgrading was reassessed, resulting in the decision to prepare a new Safety Analysis Report as a whole under the title „NPP V-1 Safety Report after Gradual Upgrading“. In clarifying the structure of the Report, it was decided and approved by ÚJD that base the new Report will follow the structure of the NRC Guideline 1.70, updated based on specific conditions prevailing at NPP V-1, while accounting for the applicable IAEA Guidelines and regulations for safety reviews of WWER units.

The objective was to prepare the NPP V-1 SAR to account for any changes in the technological systems implemented both during the previous operation and during the „gradual upgrading“. In doing this, safety analyses were required to meet all the requirements of the guidelines for the conduction of safety analyses for power plants operating WWER reactors with respect to both the range of initiating events and the approach to the solution and use of programme codes. The structure of the Safety Report is comparable with that of the NPP V-2 Safety Report.

The objectives of the individual chapters remained preserved, although the contents of some parts were adjusted and updated for the conditions of NPP V-1 since the Guideline RG 1.70 has been intended for the drafting of the safety report of new NPPs in the legal environment of the US.

Any principal deviations from the Guidelines RG 1.70 arise from the guidelines developed and issued by IAEA and ÚJD after 1993, thus accounting for the most recent level of knowledge and approaches to analyses, and approaches and taking into account also the specifics of WWER-440 reactor units.

2.1.2.3 Accident Analyses

The approach to safety review has been based on internationally approved safety standards and guidelines, accounting for the corresponding national regulations and recommendations. The ÚJD guidelines for safety analyses of WWER reactors are viewed as particularly important since they set the classification of initiating events, the set of acceptance criteria, and more stringent requirements concerning their analyses.

Initiating events (and induced processes) have been classified into two basic categories: anticipated transients and postulated accidents. In accordance with the international practice and the above mentioned references, a specific procedure was applied for selected events (Anticipated Transient Without Scram - ATWS, Pressurized Thermal Shock - PTS, radioactivity releases, internal structure loads, and selected beyond design basis events with realistic approach).

The general approach to the application of the single failure and deterministic conservative approach to the definition of scenarios were used, in accordance with the recommendations of the IAEA-EBP-WWER-01 Guideline.

Additional conservative assumptions were used (exceeding the single failure criterion), such as assumed position of the control rod stuck at the upper position or expected loss of off-site power supply.

In general, the scenarios did not include operator actions. This is based on the principle that automated systems provide sufficient time for the operator to identify emergency conditions, to analyze the conditions of the unit and to take the appropriate mitigating measures. The interval of 30 minutes is considered as sufficient.

The entire set of initiating events for sufficient numbers of variants (cases) was analyzed to cover the evaluation of every criterion and to justify the selection of the adequate conservatism of the analysis. The SAR contains explicit values for all important parameters, with the definition of initial and limit conditions for every case, enabling control as well as repeated analyses if needed.

Summary of accident analyses

Accident analyses were performed over the entire extent of the anticipated initiating events, while applying qualified methods and practices. The analytical work is in accordance with the IAEA recommendations for emergency analyses of WWER type reactors and the selection of the events was confirmed by comparing with power-plant specific PSA. All of them are included in SAR chapter 15. The whole SAR was updated so as to describe the condition of the power plant and its safety following the gradual upgrading. The structure is in accordance with the practices adopted in many developed countries.

The analyses have shown that acceptance criteria are met for transients and accidents, including design bases accident (i.e. LOCA 2 x Φ 200 mm) and for selected beyond design basis accidents, including LOCA 2 x Φ 500 mm. The analyses play a key role with respect to the conviction that the project and the implementation of the gradual upgrading of NPP V-1 have been successful.

2.1.2.4 Probabilistic safety assessment

Level 1 PSA for power operations

The level 1 PSA study for NPP V-1 was prepared in the framework of the PHARE Programme by the UK company Electrowatt Engineering Services in cooperation with RELKO and VÚJE in 1992. The objectives of the study were as follows:

- to determine core damage frequency (CDF) based on the failure trees method and event trees method,
- to identify initiating events and accident sequences with a predominating contribution to core damage,
- to assess the effects of various modifications of safety systems on CDF,
- to specify recommendations for the updating of emergency operating procedures based on predominant accident sequences.

The study assessed NPP V-1 unit 1 as a pilot unit, being on power, for the status quo of in July 1992. The study contemplated initiating events (transients and LOCA), internal fires and internal floods. In a majority of cases, own specific data for the individual intensities of component failures were used in the PSA. Published generic data were used whenever specific data were not available.

Event trees and failure trees were modeled in the Risk Spectrum software environment. A very detailed model of the unit was set up for the individual technological systems, electric switchboards and I&C systems with the corresponding controls down to the sensor and relay level. Also, this programme was used to finally quantify the model.

Results of the first Level 1 PSA study:

CDF = 1.70E-03/year

Since „small reconstruction " of NPP V-1 was under preparation during July 1992, the obtained PSA model was used to evaluate and to supplement suggested changes into the project. Under the „small reconstruction", improvements of I&C systems, electric and technological circuits were made. Also emergency operating procedures were supplemented by adding critical safety functions restoration guidelines.

The changes made in the configurations of both NPP V-1 units by the end of 1993, and the completion of symptoms-based emergency procedures resulted in a new model of Level 1 PSA.

Level 1 PSA study after „small reconstruction" was drafted in December 1993. The new model incorporated, in addition to unit hardware modifications, also remedial operator actions during accidents. The modeling of operator's interventions enabled the completion of symptoms-based emergency procedures. Values obtained from a detailed analysis of the human factor reliability, using the THERP method were used for the probability analysis of operator's error.

Results of Level 1 PSA study after „small reconstruction ":

CDF = 8.9E-04/year

Based on the results obtained from PSA study some objectives were set for the NPP V-1 „gradual upgrading“ under preparation.

Preliminary suggestions for changes in unit systems were used to set up Level 1 PSA model ”Basic Engineering”. The model was subsequently quantified, and based on sensitivity analyses, the most appropriate project of change for the individual unit systems was selected.

The **PSA model ”Basic Engineering”** was used to determine the preliminary core damage frequency - CDF of 2.57E-04/year, without symptom-oriented emergency operating procedures.

Having completed the NPP V-1 “gradual upgrading“, a new Level 1 PSA model was developed to reflect the actual status of the unit in 2000. The Level 1 PSA study after „gradual reconstruction “ of NPP V-1 was developed by Slovak engineering and research companies in cooperation with VÚJE.

Main results of the recent Level 1 PSA study:

CDF = 2.56E-05 /year

The core damage frequency meets ÚJD safety objective of 1.0E-4 / year.

Table 2.1.1 documents the results of the most recent NPP V-1 PSA study from the aspect of the contributions of the individual initiating events.

Fig. 2.1.1 Comparison of the outcome of NPP V-1 upgrading: PSA aspect

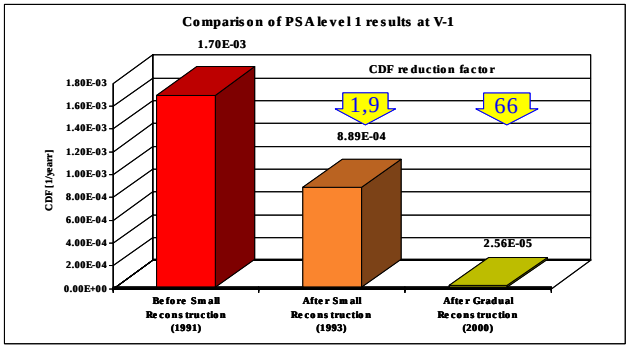


Table 2.1.1

Contributions of initiating events to RC melting frequencies			
Initiating event	**Description**	**Frequency [1/year]**	**% of overall CDF**
LL-LOOP2,5	Large leak from loop 2 or 5	7.00E-6	**23.0**
ML(32-100)	Medium leak (32-100 mm)	4.30E-3	**19.8**
SL	Small leak (0-32 mm)	2.80E-2	**15.6**
LL-LOOP1,4	Large leak from loop 1 or 4	7.00E-6	**12.8**
SGTM	SG manifold rupture	5.00E-6	**3.8**
IFL	Interfacing LOCA	5.00E-4	**3.5**
PSL	Leak from pressurizer	6.90E-4	**2.8**
SGTR	SG tube rupture	8.90E-4	**2.8**
LL-LOOP3,6	Large leak from loop 3 or 6	7.00E-6	**2.6**
FIRE-TGHALL	Fire at the machine room	6.20E-2	**2.4**
ML(100-200)	Medium leak (100-200 mm)	1.50E-4	**2.3**
2TG	Trip of both TG	5.50E-1	**2.3**
LOP	Complete failure of house power supply	2.50E-2	**2.2**
SHB	Main steam header rupture	2.20E-3	**1.3**
	Other events		**2.8**

Main recommendation of the most recent PSA study

To reduce CDF, the PSA study has recommended to develop and implement symptom-oriented emergency operating procedures - SBEOP. The development of SBEOP is in the course and implementation is expected by the year 2003.

Plans and ongoing activities related to NPP V-1 PSA

Based on the most recent PSA model for NPP V-1 the system of real-time risk monitoring system "EOOS - Risk Monitor" is implemented for power operation, for which NPP Bohunice have been licensed.

Development of Level 1 PSA study for low-power and shut-down reactor (shut down PSA) is in progress.

The PSA model will have to be updated after the development of SBEOP.

The power plant has systematically used PSA as a tool for the development and setting of priorities with respect to improvements that were implemented during the upgrading programme aimed at achieving the best safety improvements possible. Moreover, the conclusions and the results of the PSA have been incorporated into the training programme for NPP V-1 operators, and selected emergency scenarios have been implemented into the new unit simulator at VÚJE.

2.1.3 NPP V-1 units safety improvement programs

Safety improvement programme, so-called „small reconstruction" was implemented on both units within 1991-1993; based on 81 requirements of the Resolution No. 5/91 and 14 requirements of the Resolution No. 213/92 of the former ČSKAE.

Based on the amended safety analysis report for NPP V-1 (1993) drafted on the „gradual upgrading", ÚJD by its decisions No. 1/1994 and 110/1994 set areas and procedures for the adoption and implementation of measures enabling further operation of NPP V-1 units, the programme of the so-called „**Gradual Upgrading"** implemented within 1994 through 2000. The NPP V-1 units safety improvement programme was based on both probabilistic and deterministic objectives:

- probabilistic goals:
  - probability of safety systems failure must be below 10^{-3} on demand,
  - probability of reactor core damage must be below 10^{-4}/year,
  - probability of reactor protection system failure must be below 10^{-5} on demand;
- deterministic goals:
  - coping with the maximum design basis accident (LOCA 2 x Φ 200 mm) with the conservative approach and coping with beyond design basis accident (LOCA 2 x Φ 500 mm) with the best estimate approach,
  - to achieve such a tightness of containment, which ensure dose equivalents from will not be exceeded upon design basis accident and beyond design basis accidents,
  - to achieve seismic resistance of the installation of 8^{o} MSK-64

The following section describes the process of the preparation and implementation of the „V-1 Units Gradual Upgrading" programme.

2.1.3.1 Project development stage

The original Russian project with type WWER-440/V-230 units dates from the late 1960s and early 1970s.

With respect to the gradual upgrading of V-1, it was decided to develop project and safety-related documentation in two steps:

Step 1: Basic Engineering and Preliminary Safety Report

Owing to the importance and extent of upgrading works on NPP V-1, several foreign companies were invited to submit bids. Satisfactory bids were received from the companies WESTINGHOUSE and SIEMENS in early 1993, being draft bids for a principal upgrading of NPP V-1; these were rewritten in December 1993 to represent bids for gradual upgrading of NPP V-1. The selection of bids was finished in the first quarter of 1994, and the award went to SIEMENS KWU. The contract on Basic Engineering was made on 5 May 1994 (the first stage of project documentation – at the level lower than Initial Project) for gradual upgrading of NPP V-1.

It was mainly SIEMENS KWU that took care of the development of the BASIC ENGINEERING project for the gradual upgrading of NPP V-1, in cooperation with Slovak companies such as VÚJE, VÚEZ Tlmače, PPA Bratislava, EZ Bratislava, and others.

BASIC ENGINEERING dealt with the upgrading of the following areas, systems and subsystems:

1. Reactor coolant system integrity improvement
2. Upgrading of the emergency core cooling system.
3. Upgrading of the pressurizer safety valves.
4. Reinforcement and integrity improvement of the containment, including addition of isolation valves and flaps on technological and air-conditioning pipes crossing the containment boundaries.
5. Addition of the accident localization system within the containment, including hydrogen monitoring and disposal.
6. Addition to containment filtered ventilation system.
7. Upgrading of the containment spray system.
8. Installation of a new service water system for cooling of safety-related systems.
9. Upgrading of electric systems in:
    - uninterruptible electric supply 6kV, 0.4kV, 220 V DC, 220 V AC, 24 V DC – upgrading of distribution lines and buses,
    - replacement of motor generators,
    - modification of diesel generator control system,
    - installation of an additional off-site power source of house consumption,
    - provision for two independent power supply systems for safety systems.
10. I&C upgrading concerning:

- upgrading of reactor protection system and engineered safety features actuation system, including reactor power control and limitation system (two redundancies),
- upgrading of neutron flux monitoring systems,
- upgrading of and additions to the post-accident monitoring system (PAMS),
- completion of the setting up of the emergency control room,

11. Installation of additional system of emergency feed water supply.
12. Installation of additional steam generators relieve valves to the atmosphere.
13. Improvement of fire protection in existing compartments.
14. Upgrading of air conditioning systems in safety related systems compartments.
15. Modification of existing structures and construction of new buildings for:
    - emergency feed water system,
    - essential service water system,
    - air conditioning systems for electric and I&C systems compartments.

Under the contract on BASIC ENGINEERING, the following areas were also tackled:

- preliminary Safety Analysis Report (PSAR),
- system of individual equipment labeling,
- setting up of a set of standards, regulations and directives relevant with respect to gradual upgrading of NPP V-1,
- seismic capacity of the equipment,
- requalification of the existing NPP V-1 equipment.

Basic Engineering was completed in November 1996.

The outputs submitted by the developers were reviewed and commented upon by SE-EBO as well as by independent organizations, and submitted to ÚJD for approval.

Step 2: Executive projects and Safety Report drafted according to approved outputs from Basic Engineering and the Preliminary Safety Report for the individual systems. The drafting of the executive projects and of the safety report was under responsibility of the General Contractor, the REKON Consortium comprising the Consortium leader - Siemens KWU and the Slovak institution VÚJE.

ÚJD approved projects for the individual functional systems for construction permits, preliminary safety reports, executive projects, as well as individual plans of quality assurance.

2.1.3.2 Implementation of the Gradual Upgrading Project

The implementation of the gradual upgrading of NPP V-1 was organized by the REKON Consortium under a general delivery contract. The scope of the general delivery included:

- development of projects for construction permits for the individual systems,
- development of executive projects for the individual systems,
- drafting of the safety analysis report and conduction of analyses,

- development of programs of pre-operational testing,
- drafting of operating procedures,
- delivery of equipment, systems and components, including delivery of technical documentation, equipment maintenance schedules, and staff training plans,
- assembly of the systems, including pre-operational testing, commissioning and handing over to the client.

The gradual upgrading programme was partly implemented during normal operation of V-1 units, but mainly during planed unit refueling outages and overhauls (OH). The outages were extended depending on the extent of the upgrading works to be performed. The gradual upgrading commenced during unit 2 OH in 1996 and was completed during unit 1 OH in 2000.

The implementation works were divided among the following 15 functional technological systems:

1. Upgrading of pressurizer safety valves and the relief line from pressurizer to the relieve tank, that cover the "BLEED" function for "Primary Side Bleed and Feed".
2. Upgrading of the emergency feed water system, to cover the „FEED" function for "Secondary Side Bleed and Feed". The system is currently designed for 72 hours of operation without the need of being supplied by feed water.
3. Upgrading of the steam generators relieve valves, to cover the " BLEED" function for "Secondary Side Bleed and Feed".
4. Grid III Madunice – off-site emergency power supply from the near-by hydroelectric power station, to improve black-out management.
5. Upgrading of the emergency core cooling system to provide for two separate and independent redundancies, to cover the function of core cooling for extended LOCA accidents and the "FEED" function for „Primary Side Bleed and Feed". Every redundancy comprises two high-pressure pumps and one low-pressure pump. The system has been designed to be able to cope with the LOCA range and to ensure core subcriticality upon secondary system breaks and upon seismic events (a new 80 m^3 boric acid concentrate tank). The system is designed ensure core residual heat removal.
6. Improved fire resistance - 14 measures.
7. Upgrading of the electro system to provide two independent and separate redundancies. The capacity of the emergency supplies (from DG) has been doubled to provide power supply for newly installed emergency systems. The capacity of the batteries was raised from 30 minutes to 2 hours.

   - Replacement of outdated motor generators,
   - Upgrading of the DG control and excitation systems,
   - Upgrading of 6 kV, 0.4 kV, 220V DC/AC distribution switchboards

8. Upgrading of the instrumentation and control system (I&C) :

   - Replacement of reactor protection system (RTS+ESFAS) for a new digital system TELEPERM XS from Siemens,

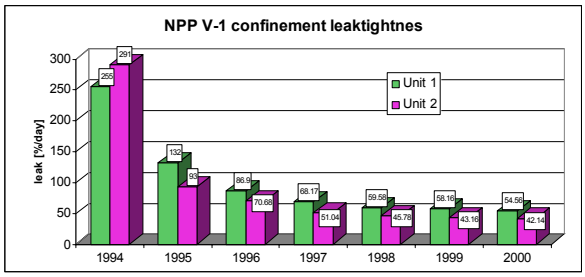
- Replacement of the reactor power control system,
- Replacement of the external neutron flux measurement system,
- Replacement of the in-core measurement system,
- Installation of a reactor power limitation system,
- Improvement of PAMS (higher number detectors),
- Improvement of radiation monitoring system.

9. Upgrading of the containment spray system to provide two separate and independent redundancies.

10. Installation of an accidents localization system within the confinement after LOCA.

11. Improvement of the confinement integrity, through adding of fast-acting flaps to the air conditioning piping at the confinement border. The tightness improvement of units 1 and 2 confinement is illustrated in Fig. 2.1.2.

Fig.2.1.2 Results of the NPP V-1 units confinement leak tightness improvement



12. Confinement reinforcement, to provide for confinement resistance against overpressure and negative pressure. For overpressure the resistance is 60kPa for DBA, i.e. break of Ø200mm, and 120 kPa for BDBA, i.e. break of Ø500mm. Resistance for negative pressure is 15 kPa.

13. Installation of the essential service water system for cooling of safety systems and its separation from old service water system (non safety related). The new system of essential service water was designed to ensure 72 hours of operation without the need of other external water source.

14. Upgrading of air conditioning systems for cooling the new electric and I&C systems compartments.

15. Improvement of the seismic resistance of equipment that may negatively effect safety systems.

A simplified draft of safety systems of the NPP V-1 primary circuit following the gradual upgrading is on Fig. 2.1.3.(a new 80 m^3 boric acid concentrate tank not included).

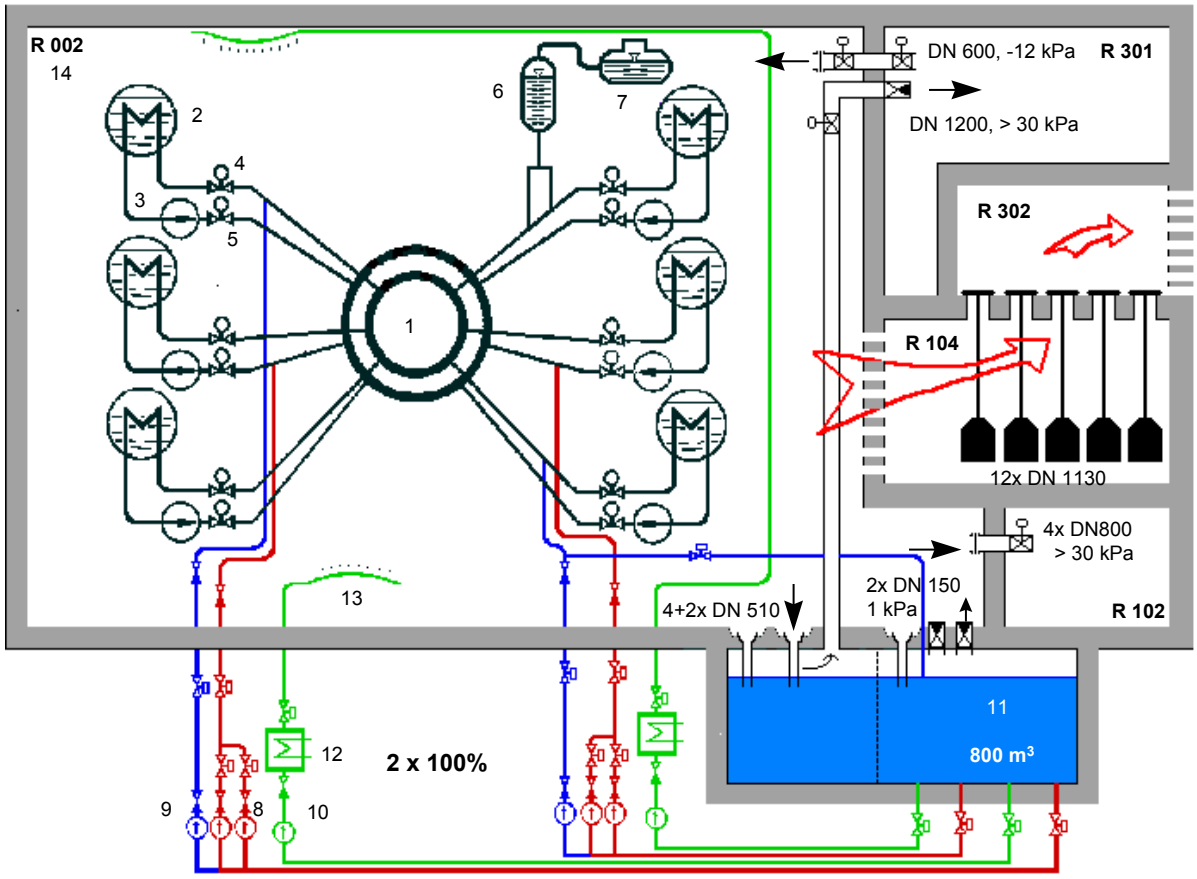


Fig. 2.1.3 Safety systems of NPP V-1 units following the gradual upgrading

1. Reactor
2. Steam generator
3. Main circulation pump
4. Main isolation valve – hot leg
5. Main isolation valve – cold leg
6. Pressurizer
7. Pressurizer relieve tank
8.HP emergency core cooling pump
9. Low-pressure emergency core cooling pump
10. Spray system pump
11. Emergency boric acid storage tank
12. Heat exchangers
13. Spray system nozzles
14. Containment

Fig. 2.1.4 illustrates time schedule of the whole gradual upgrading of NPP V-1.

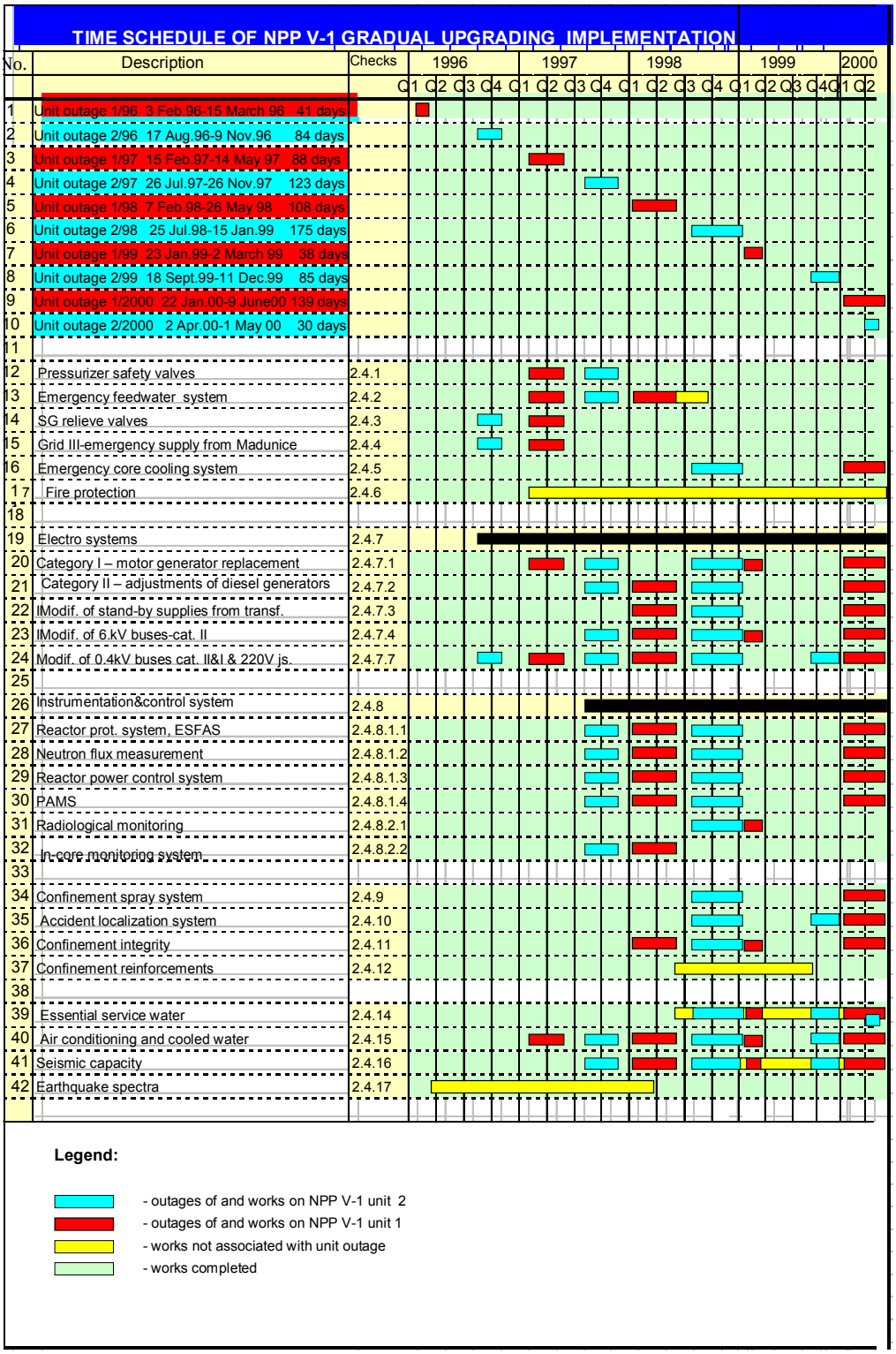


Fig. 2.1.4 Implementation time schedule of NPP V-1 gradual upgrading

Having implemented the NPP V-1 gradual upgrading programme, the objectives set by ÚJD Decision No.1/94 were met, representing a precondition for granting approval for further operation of the NPP. The

completion of the reconstruction works resulted in a marked improvement of NPP V-1´s nuclear safety standard, thus achieving the internationally acceptable standards of safety and operating reliability. At the same time, preconditions were created for a safe, reliable, economical and environmentally-friendly operation of NPP Bohunice V-1 to be continued at least through the end of its designed service life.

Previously, ÚJD approved further operation of NPP V-1 units conditional upon meeting the above criteria connected with the progress of works on safety improvement. The approval remained valid for always one fuel cycle. Based on a review of the safety report following the gradual upgrading of the units, ÚJD is about to issue a decision on the approval of continued operation of NPP V-1 unit I, stating conditions listed in the annex of the decision.

2.2 Nuclear power plant Bohunice - units V-2

2.2.1 Description of NPP V-2 units

See National Report as of September 1998.

2.2.2 Safety assessment of NPP V-2 units conducted

2.2.2.1 External review missions

- Apart from the missions mentioned to assess seismicity of the Bohunice site and Y2K issues (see chapter 2.1.2), an International IAEA Review Mission IPERS Review Mission for Bohunice V-2 NPP Low Power and Shutdown PSA – SPSA has taken place since the drafting of the National Report for Slovakia in July 1998. The Mission took place on 27 September - 6 October, 1999. The Mission stated that the documentation presented was of a high quality, the analytical method used corresponded to the recommended and world-wide used method for low-power and shutdown unit PSA development. The identification and grouping of initiating events have been in accordance with the usual practices. The event and failure trees included all the safety systems and functions relevant with respect to suppression of initiating events. The quality assurance programme applied in the PSA study has been in accordance with the instructions and guidelines. Some recommendations were given at the same time to improve the said PSA study and to improve the lucidity of descriptions.
- WENRA stated in its report “Nuclear safety in EU candidate countries”, October 2000 that, “…Once the ongoing upgrading measures have been implemented, i.e. around 2002, the safety level of these units is expected to be comparable to that of the Western European reactors of the same vintage.”

2.2.2.2 Accident analyses

Similarly as for NPP V-1 units, the approach towards the safety review of NPP V-2 has been based on internationally approved safety standards and guidelines, accounting for the relevant national regulations and recommendations.

The results of the accident analyses are part of chapter 15 of the SAR for NPP V-2. Initiating events defined by guideline RG 1.70 for pressurized water reactors (PWR) were analyzed, adjusted to the conditions of WWER-440/213, supplemented later on (following the IAEA guidelines IAEA-EBP-WWER-01) in accordance with the methodology of the latter, by the analysis of some additional casing cases of initiating events. In reviewing beyond design basis accidents, potential initiating events were chosen for the units based on an analysis of results of accident analyses conducted, under consideration of additional failures of systems and facilities.

The issues of beyond design basis accidents and/or severe accidents with respect to WWER-440/213 units were analyzed under several PHARE projects:

- PH 4.2.7a "Beyond design basis accidents analyses and accident management in V-213 units" – main beneficiary NPP V-2, additional - NPP Dukovany, NPP Paks
- PH 2.06/94 "Analysis of alternatives for filtered venting of V-213 containment" – main beneficiary NPP Paks
- PH 2.07/94 "Handling of hydrogen in V-213 containment during severe accidents" main beneficiary NPP Paks

Validation and qualification of the MAAP4/WWER computer code was also performed under the PH 4.2.7 project. The code was found to be in compliance with other codes within uncertainties typical for severe accidents analyses , and the code was demonstrated to be of use for the applications considered. Situations and processes were identified that require analyses of additional codes.

The results of independent assessment of severe accident risk, performed at ÚJD, have been summarized in the report "A Regulatory Evaluation of Severe Accident Risk and Potential Impact of Selected Severe Accident Management Actions for Bohunice V-2 Nuclear Power Plant". The evaluation was prepared in cooperation with the Swiss Inspectorate of Nuclear Safety (HSK).

Conclusions derived from PHARE projects:

- large volumes of reactor coolant and secondary side water as well as the considerable temperature margins of the core provide sufficient time for preventive measures to be taken,
- analyses performed in the field of severe accident phenomenology provided a good basis for the understanding of NPP type V-213 response,
- spraying is a rather efficient method to reduce discharges of fission products, thanks to a lowered pressure and scrubbing,
- vulnerable spots of the WWER-440/213 project were identified in relation to severe accidents, and subsequently classified into three levels of significance,
- preventive measures were suggested that were used in preparing SBEOP, as well as measures to mitigate severe accidents,
- a variety of configurations of filtered venting and containment spraying were suggested and verified in relation to radioactive substances discharge limits,
- hydrogen distribution within containment during severe accidents was analyzed, and source term were computed for hydrogen, various combinations for the reduction of its production; the analyses suggested that mitigation of severe accidents will highly probably require the installation of a powerful system to reduce hydrogen concentration .

The results of the above mentioned projects will find applications in the development of SAMG, planned to start for NPP V-2 units and Mochovce units in 2001. Several supporting and preparatory activities are simultaneously under way, including a common project of SE, a. s., NPP Dukovany and NPP Paks supported by the European Union and coordinated by the Finnish company Fortum that operates WWER units.

The integrity of the bubble-condenser system, a category III safety issue according to the IAEA document EBP 03, was verified under the PHARE/TACIS project PH 2.13/95 "Bubble Condenser Experimental Qualification". The study evaluated the bubble-condenser system as sufficiently functional under conditions of accidents, identified also some spots that require strengthening of the structure, such as between the first and the second tray, the area of tray twelve, and strengthening of the entrance control door.

2.2.2.3 Probabilistic safety assessment

PSA Level 1 for power operation

The first Level 1 PSA study for NPP V-2 was drafted in the framework of the SAR after 10 years of operation, by the Slovak companies RELKO Bratislava and VÚJE in 1994.

The objectives of the study were as follows:

- to determine core damage frequency (CDF),
- to identify initiating events and accident sequences with dominant contribution to core damage.

The study evaluated NPP V-2 unit 3 as a pilot unit on power, for the condition as of September, 1993. The events considered in the study included initiating events (transients and LOCA), internal fires and internal floods. In a majority of cases, the PSA used own specific data for the individual intensities of component failures; published generic data were used whenever specific data were not available.

The project was developed in two stages. During stage 1, the dominate contribution of electric supplies of category 2 safety systems of uninterruptible supplies toward CDF was identified. Following a change of the project that removed the shortcoming identified, an updated PSA model was developed for unit 3 as of May 1995..

Results of Level 1 PSA study for unit 3 as of 1995:

CDF = 6.41E-04 / year

Conclusions and recommendations of Level 1 PSA study:

- initiating events including break of main steamline, main steam header or feed water header in the machine room at the elevation +14,7m have a dominant contribution on CDF (41%),
- operator errors to take remedial recovery actions during accidents are among the major factors contributing towards CDF (82.7%),
- symptoms-oriented emergency procedures for operating staff have to be developed,
- independent SG feed water lines have to be installed from the emergency feed water system.

The study completed in 1995 was evaluated by the IPERS Mission organized by IAEA, which highlighted the high level and confirmed the correctness of the PSA study that was conducted according to the internationally recognized methods.

PSA Level 1 model was updated to the condition of NPP V-2 unit 3 as of July 1997, after having taken some recommended measures in the area of electric supplies to distribution switchboards, valves in treated water system, and supplements to emergency operating procedures of most important corrective actions.

The updated model was modified in cooperation with the US company SAIC to make it fit for the use in real-time risk monitoring system.

Results of PSA following the introduction of some recommended for changes:

CDF = 1.33E-04 / year

The study identified an important contribution of clogging of strainers at the emergency core cooling system pumps suction toward CDF.

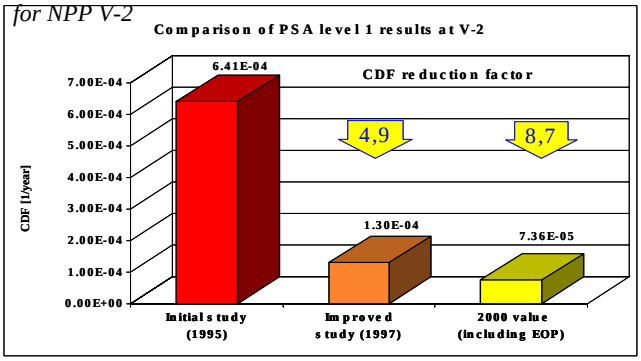
After the symptom-oriented emergency operating procedures have been put into operation at the NPP V-2 unit control room in 1999 and after the strainers at the emergency core cooling system pump inlets at SG box had been replaced, also Level 1 PSA study was updated for the condition of the NPP V-2 unit 3 as of 1 January, 2000.

Results after the implementation of recommended changes in 2000:

CDF = 7.36E-05 /year

The results of the updated study confirmed that the implementation of the new generation of emergency procedures has been associated with a reduction of core damage frequency by 35.4%. With the symptom-oriented emergency procedures in place, the unit meets the ÚJD criterion concerning CDF (Fig. 2.2.1).

Fig. 2.2.1 Comparison of the results of the various PSA studies for NPP V-2



Low-power and shutdown Level 1 PSA

Level 1 low-power and shutdown PSA study (SPSA) was completed in 1999. The project was financed by the European Commission under PHARE programme, and was developed by an international consortium of organizations comprising ENCONET, WESTINGHOUSE ES, KEMA, VÚJE, RELKO, ÚJV Řež. The study was considered as a pilot one for Soviet WWER-440/V-213 projects, and presently represents the most comprehensive probabilistic risk assessment for shutdown WWER-440 reactors. The completed study was evaluated in September 1999 by the IAEA IPERS Mission, and confirmed the correctness of the evaluation procedures used.

Results and conclusions of Level 1 SPSA study:

CDF = 6.44E-04 / year

The frequency of core and fuel damage is comparable with CDF for power operation. To reduce CDF, an extension of operating procedures for normal and emergency operation of shutdown unit has been recommended. In 2000, the study was updated due to changes performed in NPP V-2 installation.

Real-time risk monitoring at NPP V-2

EOOS Riskmonitor was implemented on NPP V-2 within 1997 to 1999, to enable real-time risk monitoring. The project was initiated in cooperation of SE-EBO and ÚJD in 1996. The development of the risk monitor was performed in cooperation with companies SAIC and RELKO, in accordance with the NRC method NUREG/CR 5925. In January 2000, EOOS Riskmonitor was implemented at NPP V-2, and is now available at the unit control room. Shutdown Riskmonitor has been in trial operation at the nuclear safety department, and its use is expected mainly for planning and coordination of works during outages of NPP V-2 units.

PSA Level 2

PSA Level 2 for power operation and shutdown was completed in March 2001 at the reference NPP V-2 unit 3. The study was developed by the Austrian company ENCONET in cooperation with the Slovak companies VÚJE and RELKO Bratislava and foreign partners. The results of the study are currently being verified.

2.2.3 Operating safety analysis report after 10 years of operation

Initial safety analysis report

The initial SAR for NPP V-2 was drafted in 1983 according to the instructions for drafting and contents of safety reports issued by ČSKAE. Based on the requirements of the approved structure, sections of preliminary safety report were taken over without any modifications, others were supplemented, and the missing sections were drafted separately.

Amended safety analysis report

In connection with the granting of approval for the operation by ČSKAE of the NPP pursuant to Act No.28/1984 Coll., ČSKAE in its Decision No. 199/91 made approval of continued operation of Bohunice NPP unit 3 conditional upon the meeting of a set of conditions. Among others, these conditions included also submission of an amended SAR that would demonstrate the status of the provision for nuclear safety after ten years of operation of NPP V-2 units.

A strategy was adopted for drafting the amended V-2 SAR. Because of the overall development in safety assessment methodologies, it was decided to draft an entirely new report, structured in accordance with the guideline US NRC RG 1.70. The objectives of the individual chapters remained preserved, although the contents of some sections were adjusted and updated to the conditions of NPP V-2 since guideline RG 1.70 has been intended for the drafting of a SAR for a new NPP in the legal environment of the US. All legal regulations applicable in Slovakia were taken into account during the safety evaluation . In areas where no regulations and standards have been defined in the Slovak Republic, international regulations and/or regulations applicable in other countries were used.

Available project data, background materials on project documents and results of safety analyses and works implemented for the purpose of improving NPP V-2 nuclear safety during ten years of operation were used for the NPP V-2 safety report.

Additions to amended SAR based on ÚJD Decision No. 4/96

Having reviewed the results of inspection for start up after the completion of the 1995 overhaul, and having assessed the amended SAR Review 1 – status as of 09/93, ÚJD granted, by its Decision No. 4/96 approval of the operation of NPP V-2 unit 3. At the same time it instructed SE-EBO to make adjustments and additions to SAR and to update it by incorporating changes introduced prior to 31 December, 1996. This updating gave rise to amended SAR V-2 – status as of 12/96.

According to the Decision and in terms of the plant standards, above V-2 SAR Revision No. 2 has to be amended every year, with changes introduced during the preceding year to be incorporated.

2.2.4 NPP V-2 units safety improvement programs

The objective of the operator is to not only maintain the present level of nuclear safety but also its improvement as suggested by new knowledge and experience from NPP operation. To meet this objective, „NPP V-2 Upgrading and Safety Improvement Programme“ was developed as described in more detail in chapter 5.4. In this section, measures implemented so far are summarized.

Selected actions relevant for NPP V-2 safety improvement which are in accordance with the Safety Concept have priority. The individual actions have been planned to become implemented during planned unit outages. So far, the following important safety and upgrading measures have been implemented:

- upgrading of the upper distribution piping of SG feeding water and feeding heads,
- installation of a pressurizer relief valve,
- first phase of the seismic reinforcements of reactor coolant system loops,
- replacement of category I uninterruptible supply accu-bateries,
- implementation of a new redundant power source at system 4 of category I uninterruptible power supply,
- introduction of symptom-oriented emergency operating procedures,
- diagnostic systems for the monitoring of small leaks from primary circuit equipment meeting LBB criteria,
- upgrading of the RC monitoring system (addition of a redundant environmental contact unit), and replacement of secondary computer system,
- measure to prevent clogging of the emergency systems pump suction and of spray system nozzles,
- installation of an automated fire extinguishing equipment for reactor coolant pump compartment,
- replacement of all generator breakers,
- replacement of electric protections of 6 kV drives,
- installation of LFC terminals for remote control of electric parameters from dispatching center,
- non-destructive tests:
  The following measures have been/are being implemented

- having increased the sensitivity of the facility to reactor pressure vessel in-service inspections from the outside, integral test was performed during the outage of NPP V-2 unit 4 and subsequently control of unit 3 during 1999 EOH,
- staff qualification follows Slovak national standard STN EN 473 and is expected to be completed in 2002,
- the programme of operation defectoscopy of I&C lines (up to the first separating valve) connected to components and of primary circuit pipe systems is going on,
- operation testing of NPP V-2 equipment is going on according to the new guideline MN-14 that applies the most recent knowledge and experience in the field of non-destructive tests, and contains operation monitoring programs for all pipelines up to the first closing valve,
- appropriate samples with implanted material defects are being prepared in cooperation with VÚJE,
- qualification of a system of non-destructive testing according to IAEA guidelines is being prepared in cooperation with VÚJE,

- fire prevention

  To improve fire safety and to resolve the safety-related problem, the following measures have been implemented or are being implemented:
  - a systematic analysis of fire-related risk was conducted in 1998 based on which a fire project will be developed,
  - to prevent spreading of smoke and fire, anti-fire flaps have been installed controlled by temperature in the corresponding air conditioning system and being independent from the other systems of the power plant,
  - cable partitions and closures at MGU were coated with Dexaflamm, an fire resistant material. Wherever redundant cables cannot be separated, certified foaming materials will be used to cover them,
  - fire resistant penetrations and barriers are subject of regular inspections,
  - water guns to cool ceiling structures were installed at the machine room,
  - semi-stable foam fire extinguishing equipment was installed to main oil tanks of turbo generators and to the oil systems of electric feed water pumps,
  - floors of cable channels with a stable fire extinguishing equipment were insulated,
  - electric fire detection was upgraded in electric buses and technological computer rooms,
  - a new firewall was built between stand-by transformers AU01 and AU02, and the original firewalls between the unit and branch transformers were extended,
  - junctions of 6 kV cables for diesel generator station were replaced,
  - signaling of the fire doors positions in cable channels of the main production building and external cable channels was installed,
  - firefighting cards were developed for the management of firefighting intervention by the plant fire brigade and operating staff.

A plant fire brigade is on duty around the hour at the Bohunice site and able to intervene at any place within minutes.

The following actions are planned to be implemented during 2001:

- project documentation resulted from the Safety Concept,
- modification of emergency low-pressure and spray pumps recirculation,
- modification – relocation of emergency feed water lines from +14.7m.

2.3 Nuclear power plant Mochovce - Units 1 and 2

2.3.1 Description of NPP Mochovce

See National Report as of September 1998.

2.3.2 Safety assessment of Mochovce units conducted

2.3.2.1 External review missions

The following external review missions to evaluate the safety of Mochovce units have taken place since the drafting in September 1998 of the National Report for Slovakia:

- IAEA mission to evaluate implementation of the Safety Upgrading Program of Mochovce NPP Units 1&2; the mission started in Vienna on 6 October, 1998 and continued in Mochovce on 12 – 16 October, 1998. The IAEA experts stated that all safety relevant issues identified by IAEA for WWER-440 /V-213 units had been resolved correctly and sufficiently.
- IAEA Mission devoted to issues of the NPP Mochovce unit 1 reactor pressure vessel, taking place on 6 – 16 October, 1998. The IAEA experts declared that they had no doubts concerning the integrity of the reactor pressure vessel.
- Repeated IAEA Mission – Assessment of seismic input data (SIDAM) of the Nuclear Power Plants Bohunice and Mochovce, taking place on 16 – 20 November, 1998. The objective of the Mission was to review the method of evaluation of seismic input data and assessment of the impact of external risk of earthquake on NPP safety. As a background material, the POSAR under preparation was used. The Mission evaluated the background documents presented and compared them with the recommendations of the safety guideline IAEA 50 - SG - S1 concerning location of NPPs. In conclusion, procedures and results achieved were evaluated as satisfactory.
- Safety review of NPP Mochovce done by RISKAUDIT (a consortium of technical organizations IPSN and GRS working for national nuclear regulatory authorities of France and Germany) under PHARE project – it was finished in December 1998. The review was a continuation of a safety review finished in December 1994. The objective of the review was to compare NPP Mochovce safety level with units operated in western countries after implementation the Safety Upgrading Programme of Mochovce NPP Units1&2. In conclusion, it was stated that „NPP Mochovce is the first power plant of the former eastern block constructed according to a Soviet project that meets the requirements put on safety of units operated in western countries“. The decision of the operator to involve Slovak, Czech, Russian, French, German and other experienced organizations made a contribution towards the achievement of the above mentioned results that reflect the combination of inherent characteristics and advantages of WWER type reactors with western technology. The permanent surveillance by ÚJD has been supported by the European Commission.
- WENRA stated in its report “Nuclear safety in EU candidate countries”, October 2000 that, “…Although some residual work is still needed to confirm all parts of the safety analyses, the safety

level of the Mochovce units 1-2 is comparable to that of nuclear power plants being operated in Western Europe. “

2.3.2.2 Accident analyses

Accident analyses were conducted for the full range of anticipated initiating events with applying qualified methods and practices. The works on the analyses have been in accordance with IAEA recommendations of the “Guidelines for Accident Analysis for WWER Nuclear Power Plants” and the selection of events was confirmed by a comparison with power-plant-specific PSA. The results have been included in chapter 15 POSAR.

In connection with the use of profiled fuel, new accident analyses were conducted in cooperation with the fuel supplier for the full range of initiating events according to IAEA-EBP-WWER-01. Only radiation impacts were not re-calculated since the increase in fuel inventory has been negligible when compared with the initial RC design.

The status concerning beyond design basis accidents and severe accidents is similar as that concerning NPP V-2 units – see chapter 2.2.2.2. with the difference, that for NPP Mochovce a study has been prepared ” Applicability of PHARE 4.2.7a/93 Project Results to EMO Units 1 and 2 and Analyses for SAMG” in the first half of 2001.

2.3.2.3 Probabilistic safety assessment

Level 1 PSA for power operation

Level 1 PSA model for unit 1 was developed to analyze risk due to initiating events and to determine prevailing sequences of accidents of core damage. The model was developed in two modifications corresponding to two different reference states of the power plant: the first modification was based on the technical condition of NPP Mochovce unit 1 at the moment of start-up. This study confirmed that the requirements of INSAG 3 including core damage frequency was met. The second study has been prepared in accordance with the technical status of NPP Mochovce unit 1 after the full implementation of the safety improvement program and was finished in December 2000. The results confirmed considerable decreasing of CDF, but Mochovce NPP decide not to publish final figures before their evaluation by IAEA experts, scheduled in November 2001.

The probabilistic safety assessment of Mochovce NPP continue by SPSA study in the same extent as level 1 PSA, including specific SPSA study objectives and application.

SPSA model is foreseen to be developed so as to enable full uses of the model in the future for the following purposes: living PSA, real-time risk monitoring (RISKMONITOR), L&C optimization , level 2 PSA, optimization of the maintenance and testing strategy.

The project SPSA started in January 2001 and the planned completion date of is July 2001.

After that will continue the probabilistic safety assessment of Mochovce NPP with PSA level 2 performance. For that purpose, asked the plant through National Regulatory Authority of the Slovak Republic (ÚJD) the European Commission to confirm a new PHARE programme, which is preliminary considered to start in second half of year 2002.

Beside that, the implementation of the RISKMONITOR, as a tool for operational risk evaluation, is scheduled to be applied after the completion of the SPSA model

2.3.3 Mochovce units safety improvement programs

See National Report as of September 1998.

2.3.3.1 Study and analyses stage

See National Report as of September 1998.

2.3.3.2 Project development stage

See National Report as of September 1998.

2.3.3.3 Implementation of safety measures

The classification of the individual safety-relevant issues was based on the IAEA document EBP-WWER-03 “Safety issues and their ranking for VVER-440 /V-213 NPPs” with the difference that the extent of safety-relevant measures has bee extended by the recommendations of RISKAUDIT, taking into account specific conditions of the NPP Mochovce.

The results of safety measures are documented in the Safety Assessment Report or in other supporting documents.

Before start up of the units safety issues of categories III and II has been fulfilled in a manner to fulfill requirements of INSAG 3 from the point of view of defense in depth.

The remaining safety measures were implemented depending on the technological possibilities during the operation, and if such measures required unit shutdown, their implementation was postponed to outages for refueling. This procedure was continuously approved and verified by ÚJD.

The safety improvement programme was evaluated after the completion of units 1 and 2 shutdown in 2001. The evaluation confirmed that the implementation of safety measures adopted within the safety improvement project which was a part of the completion of units 1 and 2 has been principally completed.

From the point of view of the IAEA document EBP-WWER-03 “Safety issues and their ranking for WWER 440 model 213 NPPs “ the task AA08 “Possible accidents during operation on low power and shut down” remains to be completed. Until now a comprehensive study of event trees has been performed including thermal-hydraulic analyses dealing mainly with the risk of boron dilution in the primary circuit. Their results have been taken into account in the safety assessment report. Within this task SPSA needs to be completed.

Safety measure I&C 09 “Equipment for monitoring accidents” (II category) remains to be completed as well which is planned for 2003 and 2004. The present equipment covers the needs for design bases accidents through EOP’s. The completion of post accident monitoring is conditioned also by developing procedures for severe accident management.

Additional safety aspects

Besides safety measures implemented during the completion of NPP Mochovce units 1 and 2 attention has been devoted also to other safety questions.

In accordance with the IAEA recommendations arising from expert missions for assessing seismic data of the site a precision of seismo tectonic and geological data is performed in 2000 and 2001. These data will be then used for the seismic PSA.

Continuous attention is devoted to the question of the containment . Despite of the fact that within the safety measures a comprehensive analyses and calculations have been performed for the whole system under maximal design bases accident, supported by number of experiments, a comparison of full scope experimental results have been performed with thermal-hydraulic calculations supported by a series of experiments within a PHARE/TACIS project. The comparison confirmed the correctness of results for the NPP Mochovce. The leak tightness of the containment during operation confirms its quality during the outages of units 1 and 2 in 2001 a leak rate of 1.6% and 1.7% have been measured.

An important step toward safety improvement of NPP Mochovce is the start up of the process of management of beyond design bases accidents. As it was mentioned earlier the start up of these works on development of severe accident management guidelines (SAMG) is expected during 2001 and at present contractual negotiations with selected supplier are going on.

2.3.3.4 Pre-operation safety analysis report

The pre-operation safety report (POSAR) was drafted based on internationally recognized standards. The overall concept was based on US NRC RG 1.70, for accident analyses representing part of this report, the IAEA document ”Guidelines for Accident Analysis for WWER Nuclear Power Plants” was used, while respecting the applicable Slovak legislation. Based on positive assessment of POSAR as well as based on reviews conducted by ÚJD inspection teams in terms of ČSKAE Decree No.6/1980 on securing of nuclear safety during start up and operation of nuclear power generating installations, ÚJD granted its approval with the commencement of physical and energetic start up of units one and two. After the start up of unit 2 , the initial and actual parameters of unit 2 were compared at ÚJD request, based on the results of inactive and active tests. Based on this analysis procedures for POSAR amendments was agreed. The comparison has been incorporated into PoBS. The most important amendments resulted from the use of profiled fuel, and chapters concerning reactor physics (chapter 4) and accident analyses (chapter 15) were reviewed in cooperation with the supplier of the new fuel. Chapters 4 and 15 of POSAR were completely replaced. Any changes and amendments made to POSAR in connection with the completion of the implementation of safety measures during the operation of the units are being continuously submitted to ÚJD for review, and incorporated into POSAR as revisions of the individual chapters so as to provide for updated POSAR. Total revision of POSAR will be made in accordance with the applicable standards after ten years of operation.

2.4 Nuclear power plant Bohunice A-1

All spent nuclear fuel produced during the operation (572 pieces of spent fuel assemblies) have been transported from the site back to the Russian Federation. The last two transports took place in 1999. The

decommissioning programme for the power plant was approved by ÚJD. According to article 2 of the Convention on Nuclear Safety. The power plant thus no more represents a nuclear installation.

2.5 Interim spent fuel storage facility

2.5.1 Description of the technology used

ISFSF represents a nuclear installation serving temporary and safe storage of spent nuclear fuel from WWER reactors prior to its further processing at reprocessing plant or prior to its final disposal. It was commissioned in 1986.

The initial status of the facility has been described in the National Report of September 1998.

The interim spent fuel storage facility was upgraded to increase its storage capacity, extend service life and raise its seismic resistance. The overall ISFSF storage capacity following the upgrading and raising of seismic resistance has been tripled as compared to the initially designed one. The capacity is being gradually increased by replacing the original T-12 containers by compact containers, and will be sufficient to store all spent nuclear fuel produced during the operation of NPP V-1 and V-2 units. Replacement of containers is expected to be completed by 2007. A computer-controlled handling equipment serves the purposes of moving spent fuel from original into new compact containers.

Raising of seismic resistance of the construction and technological parts was performed according to the project in 1999.

Owing to the increased demands on removal of residual heat from spent fuel, the original cooling system of pool waters has been replaced by a new one. The system consists of two plate coolers (one being a 100% stand-by) and 4 pumps. Heat from cooling water is removed of by an autonomous system of cooling water comprising 3 cooling micro-towers and 2 circulation pumps (one of them as a 100% stand-by).

2.5.2 ISFSF safety reviews conducted

See National Report as of September 1998.

Amended pre-operation safety report was drafted in 2000 in connection with ISFSF upgrading; the report evaluated the actual safety status of the facility. The format of the safety report was based on recommendations of the US NRC Guide No. 3.44 Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation (Water – Basin Type), and ÚJD requirements were based on § 72 CFR Title 10 USA and the documents of the IAEA safety series Nos. 116, 117 and 118.

2.5.3 ISFSF safety improvement programs

See National Report as of September 1998.

2.5.3.1 Seismic upgrade

See National Report as of September 1998.

2.5.3.2 Capacity increase

See National Report as of September 1998.

2.5.3.3 Monitoring programme

Based on recommendations of IAEA documents concerning status monitoring of construction and technological parts and spent fuel, a new monitoring programme has been under gradual implementation since 2001. The programme focuses on the monitoring of the condition of:

- building structures such as foundations of the ISFSF building, concrete structures of spent fuel pools, support steel elements and structures, fencing of the ISFSF building,
- pressure vessels and piping systems (cooling, cleaning and decontamination system),
- corrosion-induced damage to equipment and technology in contact with the fuel storage pools coolant (lining of pools, transport equipment),
- rotational engines (selected pumps and blowers),
- systems and components of electric supply (transformers, generators, motors and cables),
- spent fuel.

New monitoring points will be installed to monitor yielding of the ISFSF building, and also ground water levels will be monitored. The condition of the ISFSF pool lining will be monitored using samples of materials placed in the pools as well as using the acoustic emission method. Visual control means, control of tightness of fuel cladding and destructive control stand are used to monitor the condition of fuel.

2.6 Technologies of RAW treatment and conditioning

The following technologies are available at the nuclear installation Technologies of RAW Treatment and Conditioning for which permits for permanent operation were granted:

- bituminisation lines PS 44 and 100 (on trial operation) at building No. 809,
- treatment technologies Bohunice RAW Conditioning Center (BSC RAW) -
- incineration plant,
- super compaction plant
- concentration plant
- cementation plant

The NPP A-1 premises house the following technologies for RAW treatment and conditioning are in operation

- active waters treatment plant in building 41,
- vitrification line VICHR ,

Also, VÚJE incinerator of radioactive wastes is being operated at the Jaslovské Bohunice Nuclear Power Plants site.

2.6.1 Brief description of the technologies

2.6.1.1 Bituminisation embedding line

See National Report as of September 1998.

2.6.1.2 Active waters treatment station in building 41.

See National Report as of September 1998.

2.6.1.3 Vitrification line VICHR

See National Report as of September 1998.

2.6.1.4 Bitumenization embedding line and VÚJE incinerator

The bituminisation line has been out of operation since 1998 (see National Report as of September 1998). The radioactive wastes incineration plant remains in operation.

2.6.1.5 RAW Conditioning Center at Bohunice.

The Bohunice Conditioning Center processes RAW that may be classified under the following categories:

- combustible solid and liquid wastes,
- compactable solid wastes,
- incombustible and non- compactable wastes,
- concentrates,
- ionex resins,
- other contaminated liquids and sludge's.

BSC includes the following technologies for RAW treatment and conditioning:

- evaporator (concentration equipment),
- cementation line,
- sorting,
- incinerator,
- storage and transport equipment,
- pressroom.

2.6.1.5.1 Evaporator.

The concentration equipment receives liquid incombustible RAW from NPP A-1, NPP V-1, NPP V-2, concentrates them and forwards them to cementation line.

The very evaporator is of the flow-through type, and comprises 3 U-shaped units. The capacity of the evaporator is 500 dm^3/h for a salt contents of the wastes of 200 ÷ 300 g/l.

The bride condensate is used to rinse equipment or in the incinerator flue gases cleaning system, and/or is discharged to the environment after having been cleaned at the cleaning station in building 41 or 809.

The output product – the concentrate is collected in a tank wherefrom it is transported into the cementation plant.

2.6.1.5.2 Cementation line.

RAW enter the dosage tank of the cementation line either directly (concentrates) from the concentration plant or through inlet containers (resins – ionex and/or sludge).

RAW from the dosage tank or ashes from incinerator's dosing container are dosed according to proven formulations, auxiliary materials and cement are added to inclined mixer (with a volume of 500 dm^3).

After thorough mixing, the cement product is poured into a high-integrity concrete container (with a volume of 3 m^3). Six batches of the inclined mixer are needed to fill the container. Containers with aged and hardened cement are closed and, having been verified , they are transported to the National Repository at Mochovce. Containers with bitumen embedded products in drums and/or solid RAW pellets need 3 batches of inclined mixer to fill the empty space of the container.

2.6.1.5.3 Segregation.

Unsorted solid RAW are transported:

- as loose particles in foil,
- in 200 dm^3 sacks,
- in 200 dm^3 barrels

to the segregation room, segregation box.

RAW sorted in the box are packed into 200 dm^3 drums, and are transported according to its classification as follows::

- incombustible compactable RAW into pressroom to be compacted,
- incombustible non-compactable RAW to be directly deposited into FCC,
- combustible, packed in 15 l sacks in 200 dm^3 drums to the tilting equipment of the incinerator inlet box.

2.6.1.5.4 Incinerator

At the incinerator, existing and produced solid and liquid wastes from NPP of Jaslovské Bohunice site are burnt. The capacity of the plant represents 30 kg/h solid wastes if liquid wastes are burnt, or 50 kg/h solid wastes. Solid wastes are dosed to the feeding box through a system of boxes, the former representing a safety pass-through – loop.

The incinerator furnace has been designed as a shaft kiln fed from the top, there are no internal built-in parts in the furnace. Burning runs in two zones. In the bottom zone, a steam-air mixture is added, securing that the temperature of the burning materials will reach 900 °C thus eliminating the production of clinker and caking at the furnace walls. In the upper zone, the main volume of air is led directly above the burning materials (operation with excess oxygen) and the air volume is set so as to achieve burning temperatures of 800 ÷ 1050 °C.

Flue gases from the furnace are post-burnt in a post-burning chamber at a temperature of 850 ÷ 1100 °C. To the bottom part of the post-burning chamber water is sprayed thus reducing the temperature to 850 °C; reduction agent NOx-Out is added to this water in quantities as necessary to reduce the proportions of NOx in stake gases.

Water spraying and addition of compressed air to the mixing chamber reduce the temperature of flue gases to as low as 340 °C. Through the rapid cooling down, the temperature range of 600 ÷ 350 °C is rapidly bridged thus substantially limiting the generation of dioxins. Subsequently, flue gases are washed in washers and cleaned at HEPA-filters that catch radioactive particles with a 99.9 % efficiency.

Ashes produced at the incinerator are reduced in size by a grinder, filled into 200 dm^3 drums and will be transported to the cementation line similarly as the water used in flue gas washers. Currently, alternative processing of the ashes by compaction is being developed.

2.6.1.5.5 Storage and transport equipment.

The equipment serves the handling between the individual storage spaces and facilities of :

- concrete containers,
- 200 dm^3 drums,
- euro palettes

2.6.1.5.6 Super compactor unit

At the super compactor unit, wastes packed after sorting or transported directly in 200 dm^3 drums get compacted. By the high-pressure compactor, drums are subject to 20,000 kN. At every loading step, the pellet is ejected on withdrawal slides and placed on storage area; subsequently, it will be placed into concrete containers. At the cementation equipment, empty spaces of the container are filled with cement mixture.

2.6.2 Safety reviews of the facilities conducted

Safety reviews of the RAW Processing and Treatment Facility are being conducted in the framework of the assessment of safety documentation (safety reports, quality assurance programs, L&C) by regulatory authorities and organizations of the Slovak Republic upon the submission of the documentation at construction and commissioning proceedings. The annual reviews of the conditions of operation, of nuclear and radiation safety are presented to ÚJD.

The operated lines are subject of regular inspections by ÚJD inspectors. Any faults and/or shortcomings identified are recorded in inspection protocols as tasks required by ÚJD to be fulfilled at the deadlines set.

No international safety review of these technologies has been conducted so far.

2.7 National Repository of Radioactive Waste

The National Repository of Radioactive Wastes is a surface type repository intended for the deposal of solid and solidified low- and intermediate-radioactive wastes generated during the operation of nuclear installations and other institutions in the territory of the Slovak Republic and dealing with activities connected with the generation of radioactive wastes. The area of the repository is located about 2 km north-west of the NPP Mochovce site.

The fundamental safety requirement for the repository is that no release of radionuclides into the environment occur during the operation, during the institutional control period as well as after the completion thereof, that would cause radiation exposure exceeding the values set by the applicable legal regulations.

The repository has been constructed in a low-permeability, high sorption capacity geological formation. An artificial layer of compacted clay represents an additional barrier to radioactivity leakage. A draining system has been constructed between this layer and the deposition boxes that mouths into monitoring shafts that enable monitoring of water leaks, if any, from each deposition box. Additional basic engineering barriers against releases into the environment include concrete structure of the repository, fiber-concrete container and solidified form of the radioactive wastes.

The repository is protected against meteorological impacts by a hall that secures roofing of the deposition site throughout the process of disposal until replaced by a final cover.

The repository comprises a system of deposition boxes laid out in two double-rows, with 40 boxes each. The capacity of every box is 90 fiber-concrete containers. The total capacity of the repository is 7,200 containers with an overall volume of 22,320 m^3. The internal volume of the fiber-concrete containers is 3.1 m^3. Compacted and bitumenized waste is fixed by active or inactive cement matrix.

ÚJD granted its approval for the commissioning in December 1999

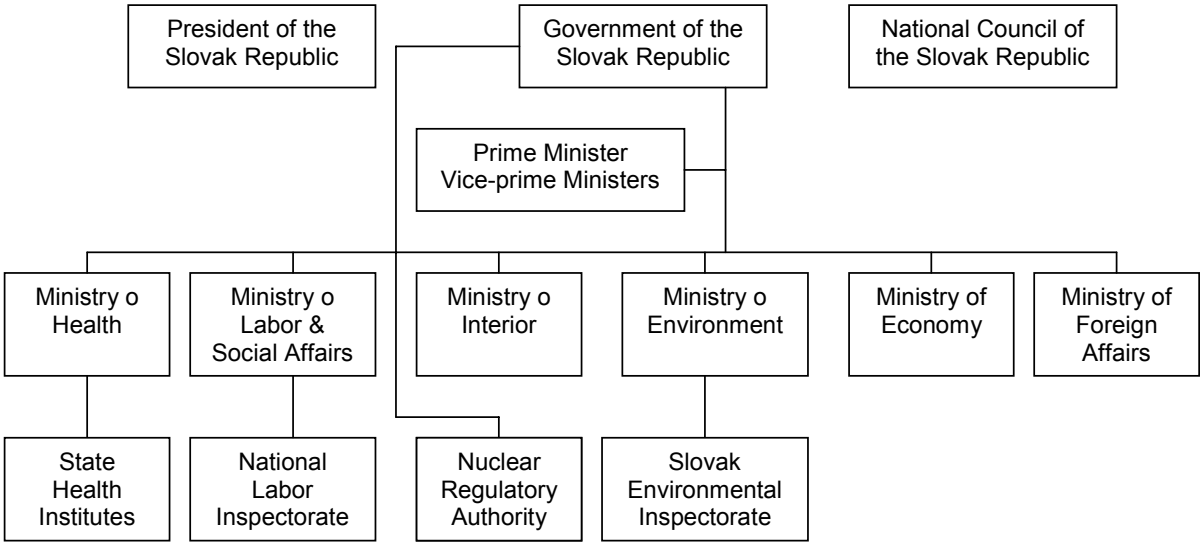
3. Legislation and regulation

3.1 Legislative and regulatory framework

3.1.1 Governmental structure of regulatory bodies

Regulation of peaceful uses of nuclear energy is exercised pursuant by governmental bodies and organisations within the framework of their competencies laid down in the corresponding laws (Figure 3.1.1).

Fig. 3.1.1 Structure of regulatory bodies



Nuclear Regulatory Authority of the Slovak republic (ÚJD)

ÚJD is a central state administration authority. It is taking care of the exercise of state regulatory activities in the field of nuclear safety of nuclear installations, including regulation of the treatment of radioactive waste, spent fuel and other parts of the fuel cycle, as well as of nuclear materials, including their control and accounting. It is responsible for the assessment of the goals of the nuclear energy programme and of the quality of selected facilities and equipments of nuclear technology, as well as for commitments of the Slovak Republic under international agreements and treaties in the said field. .

Ministry of Health of the Slovak Republic

Ministry of Health is a central state administration authority for health care, health protection and other activities in the public health sector. State administration in the field of health protection is exercised by

Ministry of Health, State Regional Hygienists, and State District Hygienists. The scope of the Ministry's activities includes, a.o. establishing radiation limits and of conditions for disposal and deposition of radioactive wastes from the aspect of their potential health-related effects; the Ministry methodologically guides health protection against effects of ionizing radiation, and grants permits for activities resulting in irradiation .

Ministry of Environment of the Slovak Republic

Ministry of Environment is a central state administration authority for the environmental creation and protection. The following bodies report to the Ministry of Environment:

- Slovak Environmental Inspectorate through which Ministry of Environment fulfills the role of the main state supervisor in environmental matters,
- Slovak Institute of Hydrometeorology.

Ministry of Interior of the Slovak Republic

Among others, Ministry of Interior is a central state administration authority for conceptual management and control of fire protection, establishing integrated emergency system, including civil protection of the population and property, public order and personal security. In case of nuclear and radiation accidents, it is also responsible for the organization of aid to the population

Ministry of Economy of the Slovak Republic Ministry of Economy of the Slovak Republic is a central state administration authority for (a.o.) nuclear energy industry, including the treatment of nuclear fuel and of radioactive waste, permitting of imports and exports of nuclear related materials and equipment.

Ministry of Labor, Social Affairs and Family of the Slovak Republic

National Labor Inspectorate reports to Ministry of Labor, Social Affairs and Family. Being a state administration authority, it performs a.o. industrial inspections in nuclear energy sector.

3.1.2 Legislation

3.1.2.1 Introduction

The legal structure of regulatory activities in the field of nuclear safety is made up of laws adopted prior to the establishment of the Slovak Republic and, on the other hand, of new laws enacted after the establishment of the independent state.

The legal system may be classified as follows:

1. The supreme basic law of the state is the Constitution that is adopted by the parliament – it is of generally binding nature.
2. Laws lay down principal rights and responsibilities specifying the principles in various areas; they are adopted by the parliament, and are of generally binding nature.

3. Government ordinances are subordinated to laws, and are adopted by the government – they are of generally binding nature.
4. Regulations and orders are rules issued by central state administration authorities (such as ministries or ÚJD) to set the details of the implementation of laws and government ordinances – they are of generally binding nature.
5. Guides (handbooks) contain detailed requirements and recommended steps to secure meeting of requirements. They are issued by regulatory bodies and not mandatory.
6. Internal standards (such as directives and orders) are internal organizational rules of regulatory bodies, and make up the basis for the internal quality assurance system.

3.1.2.2 Legal regulations in the area of state regulatory activities

On 1 April, 1998, National Council of the Slovak Republic adopted **Act No. 130/1998 Coll.LL.** – Act on Peaceful Uses of Nuclear Energy (so-called Atomic Act). The Act has laid down conditions of safe uses of nuclear energy for exclusively peaceful purposes, in accordance with international agreements signed by the Slovak Republic. Also, it includes clauses setting financial compensation in cases of nuclear accidents. It sets the amount of Sk 2 bn as the limit of operator's financial liability. In terms of the Atomic Act, nuclear installations mean facilities and premises that contain a nuclear reactor utilizing fission reaction, facilities and premises for the production, processing and storage of nuclear materials, facilities and premises for the storage (disposal) of spent nuclear fuel and for the processing, treatment, storage and deposition of RAW.

The Act came into force on 8 May 1998 and has been effective since 1 July 1998, replacing the previously applicable Act No. 28/1984 Coll. on state regulatory activities in the field of nuclear safety of nuclear installations. Some previously applicable decrees and regulations have remained applicable unless in contradiction with the law. Gradually, they are getting replaced by new regulations.

Act No. 347/1990 Coll. as amended, lays down tasks and responsibilities of central state administration authorities. Act No. 2/1993 Coll.LL. was one of the several amendments to Act No. 347/1990 Coll., laying down, a.o. the establishment of ÚJD.

Being one of the basic laws, **Energy Act No. 70/1998 Coll.LL.** regulates the conditions of doing business in the nuclear energy sector in the Slovak Republic, as well as the rights ad responsibilities of natural persons and legal entities doing business in this field.

Act No. 127/1994 Coll.LL. on environmental impact assessment orders comprehensive expert and public assessment of environmental impacts of selected constructions under preparation, including nuclear installations, and empowers Ministry of Environment of the Slovak Republic to review all suggestions for technical changes of nuclear installations that may have untoward environmental impacts.

Act No. 254/1994 Coll.LL. as amended and Regulation No. 14/1995 Coll.LL. established the State Fund for the Decommissioning of Nuclear Power Generating Installations and Treatment of Spent Nuclear Fuel and Radioactive Wastes. Treatment of spent nuclear fuel and radioactive waste means their transport, processing and disposal . The Fund that is an independent legal entity is managed by the Ministry of Economy . The Fund is financed from several sources, including contributions from nuclear power plant operators, banks, the State, and others.

Act No. 272/1994 Coll.LL. on the protection of Public Health, as amended and supplement by Act No.290/96 Coll.LL. and Act No.470/2000 settles general requirements for protecting health, state authorities their responsibilities, responsibilities of persons for health protection, requirements for the execution of state regulation and enforcement. Chapter on radiation protection establishes basic principles of radiation protection conditions and requirements for granting permissions for activities leading to irradiation and for activities important from the point of view of radiation protection and requirements for handling radiation sources and institutional radioactive wastes, responsibilities of license holders, conditions for releasing radioactive materials into the environment, requirements for radiation protection of the public and workers.

Regulation No. 12/2001 Coll.LL. on requirements for the securing of radiation protection laid down general requirements on health protection, health protection bodies, their scope of activities, responsibilities of individuals with respect to health protection, requirements with respect to the exercise of state regulatory activities in the health sector, and sanctions. In the section dealing with radiation protection, it sets basic principles of radiation protection, conditions and requirements for permits to perform activities resulting in irradiation and activities relevant from the aspect of radiation protection to be granted, basic requirements for treatment of radiation sources and institutional radioactive waste, responsibilities of permit holders, conditions for the introduction into the environment of radioactive substances, requirements for radiation protection of workers and population, including irradiation limits, details of optimization of radiation protection, requirements for the securing of radiation protection upon accidents and incidents.

Act No. 50/1976 Coll. on physical planning and rules of construction (so-called Construction Act) as amended, lays down the responsibility of the building authority to obtain, prior to granting location permit, building permit and commissioning decision concerning constructions containing nuclear installation, ÚJD´s position, the latter being allowed to make its approval conditional upon meeting specific conditions.

3.1.2.3 Suggestions for legislative amendments

ÚJD works on the following drafts of regulations :

- on periodic reviews of nuclear safety,
- on requirements for securing nuclear safety upon designing nuclear installations,
- on requirements for securing nuclear safety upon commissioning and operating nuclear installations,

- on requirements for nuclear safety of nuclear installations upon their location,
- on safety related documentation of nuclear installations,
- on quality assurance of nuclear installations

which have been sent to entities for informal commenting. A list of regulations adopted (since 1998) is in Annex No. 6.2

3.1.3 Regulation in the field of nuclear safety

The key document is the Act No.130/1998 Coll.LL. Based on it, regulations are being drafted and ÚJD decisions are being issued. For the time being, also some regulations drafted during the time of former Czechoslovakia are still applicable.

ÚJD issues a variety of decisions, including licences, permits, approvals, consents. They concern the following types of decisions:

a) it grants and withdraws authorization to and from legal entities and natural persons,

b) it grants and withdraws permits to

1. receive nuclear materials and their utilization ,
2. management of radioactive waste and spent nuclear fuel,
3. import or export nuclear materials, special materials and equipment,
4. transportation of nuclear materials,
5. decommissioning of nuclear installations,
6. change the purpose of nuclear installation through reclassification of nuclear installation with different purpose,
7. re-imports of radioactive waste;

c) grants consent to

1. construct nuclear installations,
2. design changes during the construction, operation and decommissioning of nuclear installations that may impact nuclear safety,
3. start individual stages of commissioning of nuclear installations,
4. operate nuclear facilities,
5. extend the operation of nuclear installations;

d) approves

1. types of transportation equipment for the transportation of nuclear material or radioactive waste,
2. limits and conditions for safe operation of nuclear installations,

3. programmes for commissioning of nuclear installations split into stages,
4. study principles, including technical equipment used, at specialized institutions for the training of employees in respect of whom a professional qualification or a particular professional qualification is required
5. quality systems and requirements for the quality of nuclear installations and activities,
6. on site emergency plans;

e) orders :

1. transfer of nuclear materials,
2. management of radioactive waste where no originator is known,
3. reduction in the output or shut down of a nuclear installations or its construction, suspension of the use of nuclear materials or of radioactive waste management;

f) verifies the professional qualification of selected employees.

g) supports within its competence international cooperation

h) ensures public relation

ÚJD grants authorization for

- siting, designing, construction, imports, commissioning, operation and upgrading of nuclear installations and their decommissioning,
- designing, construction, production, imports, assembling, testing, maintenance, repairs and upgrading of selected facilities,
- acquisition and using of nuclear materials, with the exception of their transport,
- treatment of radioactive wastes and spent nuclear fuel,
- professional training of nuclear installations staff at specialized facilities.

The conditions for the granting to legal entities of licenses include:

- registered address in the territory of the Slovak Republic,
- legal capacity, good character and reliability of the statutory body or at least one statutory body member,
- demonstration of professional competence of the staff performing activities according to the Act.

The conditions for the granting of licenses to natural persons include:

- permanent residence or long-term residence in the Slovak Republic,

- professional competence,
- capacity to take legal actions,
- unblemished reputation and reliability,
- health related capacity.

The condition for granting of licenses to legal entities and natural persons is the demonstration of financial, technical, material and organizational capacities, including quality systems for due performance of the activities in the relevant areas.

Pursuant to this Act, any person shall be deemed of good character who has not been enforceable sentenced of a criminal offence committed by negligence, whose subject matter is connected with the scope of the license or of a criminal offence committed deliberately.

Pursuant to the Act, a person shall not be deemed reliable who

- demonstrably indulges in excessive consumption of alcoholic beverages,
- uses addictive substances, use of which may cause dependency upon them .

Professional competence means completed university education in an appropriate area and three years of practical experience in the field.

The written application for the granting of license shall include,

a) for legal entities, name, registered address and identification No.,

b) for natural persons, given name and surname, birth No. and domicile or long-term residence,

c) for legal entities and natural persons,

1. scope, type, extent and place of doing business or performing activities,
2. period during which the given person intends to perform the respective activities.

The following shall be attached to the application:

a) for legal entities,

1. extract from Commercial Registry if the legal entity is an entrepreneur,
2. association or foundation document for newly established business entities,
3. extract from criminal records in respect of the statutory body or members thereof,
4. a document on professional competence of the statutory body or at least of one member thereof,
5. documents of professional competence of the staff,

b) for natural persons,

1. statement on domicile or long-term residence in the territory of the Slovak Republic,
2. extract from criminal records,
3. documents of professional competence,
4. medical opinion concerning health-related capacity,

c) **legal entities and natural persons** shall produce evidence for financial, technical, material and organizational capacities, including quality systems for due performance of activities for which license is applied**.**

Acquisition and uses of nuclear materials

- Nuclear materials may only be acquired and used based on permit issued by ÚJD.
- ÚJD may grant permits for longer time periods, however not exceeding ten years.

Transport of nuclear materials

- Nuclear materials may only be transported based on transportation permits issued to carrier or consignor by ÚJD.
- Only transport equipment types approved by ÚJD may be used to transports nuclear materials.

Construction of nuclear installations

- ÚJD shall decide on the granting of approvals for the construction of nuclear installations based on developer's written application with the following safety-related documents attached:

a) safety report,

b) terms of reference of the nuclear installation,

c) preliminary radioactive wastes handling plan and/or handling plan for spent nuclear fuel,

d) conceptual plan for the decommissioning of the nuclear installation,

e) classification into safety grades of selected equipment,

f) preliminary plan of physical protection,

g) quality assurance programme for the construction stage,

h) preliminary on-site emergency plan,

i) suggested limits and safe operation conditions,

j) preliminary pre-operation inspection programme for the nuclear installation,

k) preliminary environmental radiation programme for the area adjacent to the nuclear installation.

The approval at the same time represents approval granted pursuant to a separate regulation.

Approval of the commissioning of the nuclear installation shall be granted by ÚJD against operator's application with the following safety-related documentation attached:

a) for approval:

1. limits and conditions of safe operation,
2. nuclear installation commissioning programme spited into stages,
3. quality assurance programme,
4. on site emergency plan,

b) for review:

1. pre-operational safety report,
2. plan of physical protection ,
3. radioactive wastes and spent nuclear fuel management system,
4. conceptual plan of decommissioning of the nuclear installation,
5. programme of in-service inspection of equipment (components and systems),
6. selected operating procedures,
7. test programmes for equipment and systems important to safety,
8. evidence of special qualification of employees,
9. documents evidencing the preparedness of the nuclear installation for start up,
10. insurance documents and/or documents on other financial safeguards (§ 30),
11. environmental radiation monitoring in the vicinity of the nuclear installation.

Approval of the operation of a nuclear installation shall be granted by ÚJD based on the operator's application with a report on the evaluation of the commissioning of the nuclear installation attached.

Extension of the period of operation of nuclear installations

ÚJD may extend the validity of its approval of the operation of a nuclear installation based on the actual condition of the facility and based on additional safety documentation.

Treatment of radioactive wastes

- License holder may only handle radioactive wastes based on ÚJD permit.

Nuclear safety and quality assurance

Any safety relevant changes made during the construction, operation and decommissioning of nuclear installations must be submitted by developer or operator to ÚJD for approval.

Professional competence

- Only professionally competent employees may perform safety relevant working activities in nuclear installations whose professional competence has been verified by an examination commission established by the legal entity or the natural person holder of license for professional training of the staff of nuclear installations at specialized facilities (hereinafter „specialized facilities“) that granted them certificate of professional competence.
- Only selected employees may perform working activities with direct impact on nuclear safety during the operation of nuclear installation whose special professional competence has been verified by ÚJD that granted them special professional competence certificates.
- Employees of specialized facilities who perform theoretical and practical professional training of selected employees may perform such activities only based on authorization granted by ÚJD.

Quality assurance

- Quality systems and requirements for the quality of nuclear installations and activities are subject to approval and control by ÚJD.

Emergency planning

Emergency plans and emergency transport schedules shall be approved as follows:

- on-site emergency plans are approved by ÚJD,
- off-site emergency plans (population protection plans) are approved by Ministry of Interior of the Slovak Republic,
- emergency transport schedules are approved by Ministry of Transport, Posts and Telecommunications of the Slovak Republic.

In general, decisions may be characterized as law application acts. In other words, they concern the application upon specific cases of a specific entity of rights and responsibilities laid down in generally binding legal regulations. Decisions issued by administrative authorities are referred to as individual administrative acts. Obligations imposed upon by decisions are enforceable and failing to act upon them is sanctionable. Decisions however are principally subject of petitions filed with courts concerning reviews of the decisions. Courts however will not review decisions excluded from their competencies in terms of the Rules of Civil Court Proceedings.

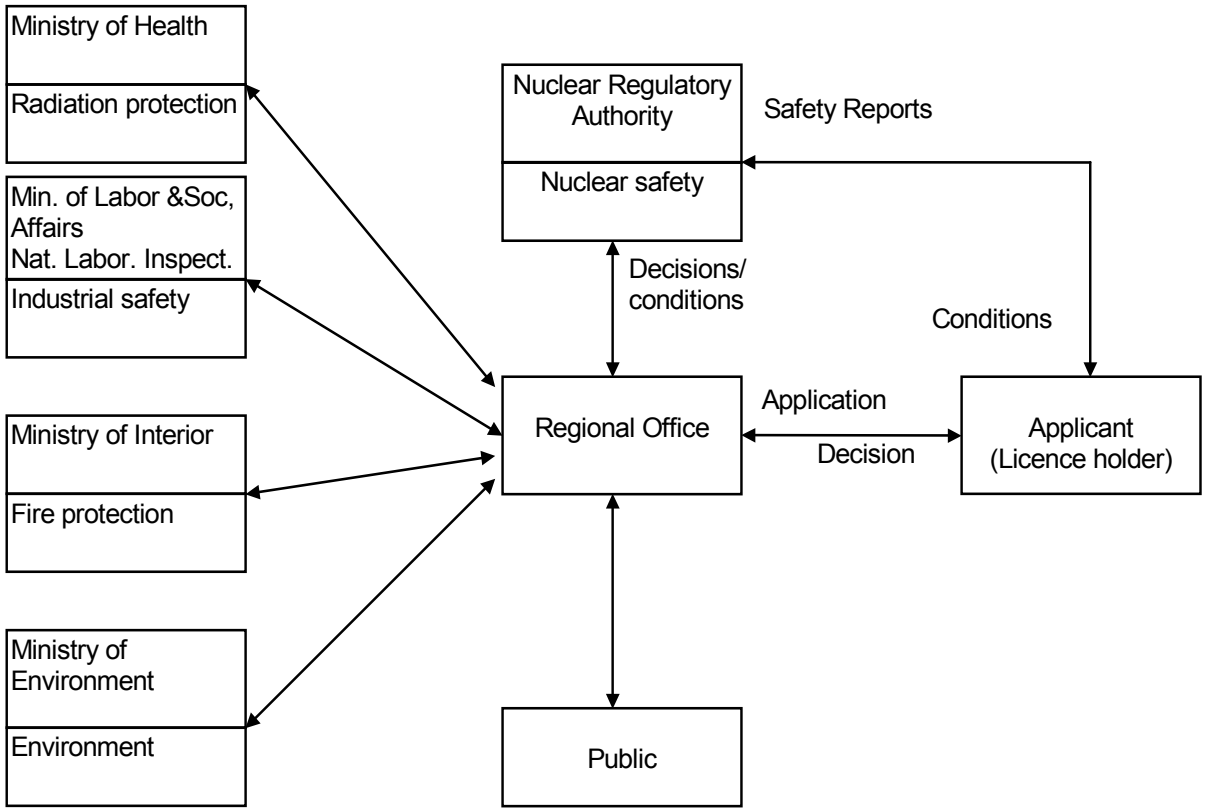
In addition to generally binding legal regulations, ÚJD also issues safety guidelines that assist operators complying with the generally binding regulations (see chapter 6.2).

Standards and recommendations of International Agency for Atomic Energy are used and applied to in the approval procedures for nuclear installations.

3.1.3.1 Proceedings for the licensing of nuclear installations

The license proceedings comprise three major steps: site selection, commencement of construction and standing operation. Prior to granting the license for standing operation, the regulatory body performs inspections according to the approved programs of hot and cold tests, and grants approval of fuel loading, physical start up, energetic start up, and trial operation. Figure 3.1.3.1. illustrates the major regulatory bodies and the procedure for the licensing of standing operation.

Fig. 3.1.3.1 Licensing procedure



The principal conditions key for the granting of the approval from the aspect of nuclear safety include drafting and submission of safety report and other prescribed safety-related documents, and meeting of the conditions of the preceding approval proceedings and of decisions by the supervisory body.

Environmental departments of Regional Offices issue decisions concerning site selection, construction, operation and decommissioning of nuclear installations based on the approval of ÚJD, Ministry of Health bodies and of other authorities and agencies of state administration. With respect to approvals and consents, the responsibilities of the authorities are laid down in Act No. 50/1976 Coll. (Building Act), by orders of the Czechoslovak Commission for Atomic Energy issued under Nos. 2/1978 and 4/1979, and by Regulations of Ministry of Environment of the Slovak Republic Nos. 453/2000 Coll.LL. and 55/2001 Coll.LL.

License holder is liable for the safety of the nuclear installation in question.

Construction

The information required for construction to be permitted from the aspect of nuclear safety include (§14 (3) of Act No. 130/1998 Coll.LL):

- safety report,
- terms of reference for the nuclear installation project,
- preliminary RAW and/or spent fuel treatment plan,
- conceptual plan of the decommissioning of the nuclear installation,
- classification of selected facilities with safety relevance,
- preliminary plan of physical protection,
- quality assurance programme for the construction stage,
- preliminary on-site emergency plan,
- draft L&C of safe operation,
- preliminary pre-operation control plan for the nuclear installation,
- preliminary environmental radiation control plan for the vicinity of the nuclear installation.

Commissioning

The information required for the approval of operation from the aspect of nuclear safety include (§15 (2) of Act No. 130/1998 Coll.LL.):

- L&C,
- nuclear installation commissioning programme, divided into stages,
- quality assurance programme,
- on site emergency plan,
- pre-operational safety report,
- physical protection plan,
- RAW and spent fuel management plan,
- conceptual plan for the decommissioning of the nuclear installation,
- in service inspection plan for equipment (components and systems),
- selected operating regulations,
- testing programs of safety-relevant equipment and systems,
- documents evidencing professional competence of the staff,
- documents evidencing the preparedness of the nuclear installation for start up,
- documents on insurance obtained and/or on other financial safeguards,

- environmental radiation monitoring of the vicinity of the nuclear installation

Operation

The information required for the approval of the operation from the aspect of nuclear safety to be granted include (§ 15 (3) of Act No. 130/1998 Coll.LL. and § 28 of ČSKAE Decree No. 6/1980 Coll.) :

- Evaluation report of the commissioning stage of the nuclear installation,
- operating L&C,
- complete operating documentation corresponding to the as-is condition of the construction,
- complete operating regulations for the nuclear installation and for every functional position, including a list of such regulations,
- list of nuclear safety relevant deviations from the approved project,
- documents and testing protocols for selected systems of protection and control and additional systems relevant for the securing of nuclear safety (signaling system, emergency cooling system, etc.),
- list of nodes, systems and equipment of principal potential impact on nuclear safety of the nuclear installation, and numbers of their functional tests and inspections,
- ÚJD-approved operating control programme and the corresponding quality assurance programs and operating controls,
- staff examination protocols and documents on training and authorization of workers to perform activities connected with the working position, including an overview of the changes,
- emergency plans,
- report on the outcome of trial operation,
- report on the meeting of the conditions shown on the individual ÚJD approvals,
- annual operation time schedule,
- a document on the preparedness of the nuclear facility and the staff for permanent operation.

Decommissioning

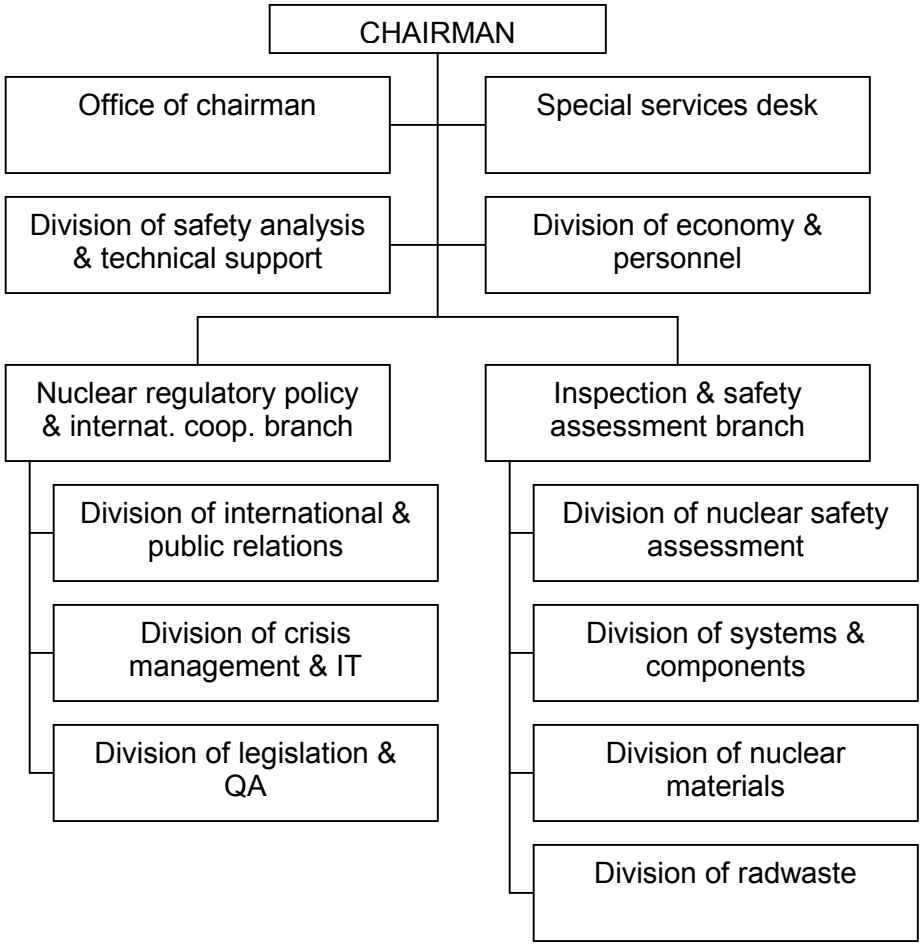
Conceptual plans of decommissioning and environmental impact assessment of the decommissioning are required for the long-term development and selection of the decommissioning strategy of nuclear installations.

To obtain permit for the individual stages of decommissioning according to the strategy selected, the operator presents to ÚJD limits and conditions of safe decommissioning, quality assurance programme, and internal emergency plan for approval. It presents for review plans of decommissioning stages, concept of decommissioning for the period after the completion of the stage to be approved, physical protection plan, system of radioactive waste management, environmental radiation control programme for the areas adjacent to the nuclear facility, equipment control programme, selected operating procedures, documents on professional competence of the staff, and documents on insurance and/or another financial safeguards.

3.1.3.2 Regulatory body - ÚJD

ÚJD is the successor to the former ČSKAE. It was established on 1 January 1993 and its responsibilities include those provided for by the Act of National Council of the Slovak Republic No. 2/1993 Coll.LL. ÚJD is an independent state regulatory authority that reports directly to the government, and that is headed by Chairman appointed by the government. Independence of the regulatory authority of any other body or agency dealing with the development or utilization of nuclear energy is being applied in all relevant areas (legislation, human and financial resources, technical support, international cooperation, enforcement tools). As of 1 January 2001, there were 82 employees at ÚJD. The following figure illustrates the organigram of the authority:

Fig. 3.1.3.2 ÚJD organigram



The development of ÚJDś internal quality system started in November 1999, and its implementation will enable a better and more efficient meeting of ÚJD´s growing tasks. ÚJD Chairman's declaration on quality analyzed the need for the provision for a high quality of tasks to be fulfilled by ÚJD, of responsibilities vis-à-vis the public in matters of nuclear safety and environmental protection. ÚJD´s management declared its awareness that ÚJD´s tasks cannot be perfectly fulfilled unless a quality system is in place whose setting up and implementation has full support on the part of ÚJD´s Chairman. At the same time, the basic principles were set for the quality system setting up and the need was voiced of an active approach on the part of all ÚJD´s staff.

In working together with an external agency, analysis of the possibilities of using the previous regulatory acts as a basis for future quality guidelines was performed. The first draft of a quality handbook was developed to be reviewed by an external agency; the latter recommended to adjust the structure of the handbook so as to creatively apply the ISO standard 9001:2000. Based on the recommendations mentioned, the second draft of the quality handbook was prepared that also analyzed the need for the development of new quality guidelines for activities the system is expected to be applied to. A single method was used to develop network diagrams of selected activities that represent the basis of the quality handbook and served the identification of the need of amendments to the existing internal guidelines and of the definition of new ones to be developed according to the single guidelines whose draft was prepared by an external agency.

3.1.3.3 The role of the regulatory body

Pursuant to Act No. 2/1993 Coll.LL., ÚJD provides for the exercise of the tasks of the state regulatory body for nuclear safety of nuclear installations, including regulation of the treatment of radioactive wastes, spent fuel and other parts of the fuel cycle, as well as of nuclear materials, including their control and accounting. It takes care of the assessment of the goals of the nuclear energy utilization programme and of the quality of selected facilities and nuclear technology devices, as well as of the commitments of the Slovak Republic under international agreements and treaties concerning nuclear safety of nuclear installations and management of nuclear materials (see chapters 4.5, 4.7 and 5).

Pursuant to Act No. 130/1998 Coll.LL., ÚJD is the state regulator in the field of nuclear safety of nuclear installations; in particular, it

- performs inspections of workplaces, places of operation and premises of nuclear facilities, checking on the compliance with the responsibilities under the Atomic Act, regulations issued based thereon, operating regulations, adherence to limits and conditions of safe operation, quality assurance systems as well as the responsibilities arising from measures and instructions issued pursuant to the Atomic Act (see chapter 3.2.2.1),
- verifies the compliance with the commitments under international agreements and treaties, in nuclear safety, management of nuclear materials, radioactive waste from nuclear facilities and treatment for disposal and disposal of institutional radioactive wastes, management of spent nuclear fuel, including accounting and control,
- identifies the status , reasons and consequences of accidents, incidents and selected failures, and takes part, being a mandatory body, in the investigations of incidents and accidents led by other authorities,

- checks the performance of mandatory inspections, reviews, operating controls and tests of selected equipment in nuclear facilities,
- orders the elimination of shortcomings impacting upon nuclear safety,
- reviews nuclear safety of nuclear facilities independently of the operator (see chapter 4.5),
- checks the contents and exercise of emergency plans.

ÚJD edits annual reports on the outcomes of regulatory activities and on nuclear safety. The annual summary reports are submitted to the Slovak Government.

3.1.3.4 International cooperation

Cooperation with International Atomic Energy Agency (IAEA)

In the view of the international importance and the broad range of opportunities for technical assistance, cooperation with the Vienna-based IAEA is of top significance. In working together with the Slovak Ministry of Foreign Affairs, the Slovak Republic has been fulfilling its commitments toward this organization fully and timely.

In the field of technical projects, the cooperation between the Slovak Republic and IAEA has been exceptionally successful. Slovakia participated in 2001 in the development of 5 national and 26 regional projects as well as in several scientific projects etc.

Significant amounts of the regional projects concerned nuclear safety issues. In the framework of regional projects, the Slovak Republic has been organizing fellowships for foreign experts, seminars, workshops and training courses with broad international participation. They are focusing on issues ageing of NPP components , radiation protection, safety culture, and utilization of nuclear technologies in the health sector.

Cooperation with the Organization for Economic Cooperation and Development's Nuclear Energy Agency (OECD/NEA)

On 14 December 2000, the Slovak Republic was officially granted membership of the Organization for Economic Cooperation and Development (OECD). The granting of OECD membership created preconditions for Slovakia's being accepted by OECD Atomic Energy Agency (OECD/NEA). Following Slovak Government's resolution, official application of Slovakia to be granted membership in the organization was filed with OECD/NEA in March 2001.

ÚJD had cooperation with OECD/NEA already in the past, in particular with the legislative division, where Slovakia has observer status. ÚJD representatives have been participating in the meetings of the Government Experts Group on third-country nuclear liability, of government experts on the Committee for Safety of Nuclear Installations (CSNI), and of the Committee for Nuclear Regulatory Activities (CNRA).

Cooperation with the European Commission and European Union Member States

ÚJD representatives take regularly part in the meetings of the leading representatives of European nuclear regulatory authorities attended by European Union representatives (CONCERT), meetings of the

European Nuclear Installations Safety Group (ENIS-G), and of the Nuclear Regulators Working Group (NRWG), with the aim to exchange opinions on the assessment of the nuclear safety standards of nuclear installations in Europe.

Among the important activities in this area was the report of the Western European Nuclear Regulators´ Association (WENRA) that reviewed the state of the nuclear safety in associated countries. The report that was provided to Slovakia in November 2000, principally evaluated the status of the legislation in the said area positively, as it did with respect to the progress achieved in the process of the safety improvements of nuclear power plant operation. The report at the same time stated that some safety analyses concerning loss of coolant accidents (LOCA) and confinement at NPP V-1 require some additional work. The NPP V-2 safety improvement programme is expected to be continued aiming at the implementation of safety relevant measures. The safety standard of the NPP Mochovce units is comparable with the safety standard of nuclear power plants operated in Western Europe.

Bilateral cooperation

There is formal (based on international agreements) as well as informal cooperation running with all neighboring countries (the Czech Republic, Poland, Ukraine, Hungary, Austria) as well as with other countries (such as Armenia, Bulgaria, Germany, France, Finland, Japan, Spain, Slovenia, the United Kingdom, USA). The cooperation focuses on mutual exchange of experiences in the peaceful uses of nuclear energy, on issues concerning establishment of emergency preparedness system, accident analyses, etc.

Forum of Nuclear Safety Regulatory Authorities of Countries Operating WWER Nuclear Power Plants

The Forum was established for the purpose of mutual exchange of experiences in constructing and operating WWER nuclear power plants. The activities are also being supported on the part of IAEA and other developed countries with nuclear programs. Ad hoc working groups are established in the framework of the Forum that deal with actual issues of nuclear safety and state regulation.

Group of Nuclear Regulatory Bodies of Countries with small Nuclear Programme The Regulators Network of Countries with Small Nuclear Programs (NERS) was established in 1998 at the initiative of the Swiss Regulator (HSK) to strengthen cooperation and exchange of experience among countries with similar nuclear programs. ÚJD has been taking regular and active part in NERS activities.

3.1.4 Regulation in the field of health protection against radiation

The role of the state health regulator in nuclear facilities is to verify how radiation protection of workers and of the population in the vicinity of a nuclear installation is being provided for. The principal requirements with respect to health protection against radiation have been laid down in legal regulations mentioned in Section 4.6.1.

Since, in the end-effect, the ÚJDś safety requirements on technological equipment and operation of nuclear installations based on the requirements related to health protection and vice versa, cooperation of ÚJD and Slovak Ministry of Health is of importance, as they are complementary. ÚJD and MZ SR made an agreement whose objective has been coordination of regulatory activities and provisions for the complementarity of regulation. A joint commission on issues of common interest was established under the agreement.

3.1.4.1 Approval proceedings

Approving of activities resulting in irradiation follows Act No. 71/1967 Coll. on administrative proceedings. Act No. 470/2000 Coll.LL. on public health protection, as amended, lays down detailed conditions for granting permits, including in particular:

- requirements on applicants for permits,
- requirements on expert representative for the provision for radiation protection,
- requirements concerning the contents of the application for permit,
- list of documents to be approved and other documents.

The Act further lays down the terms of the permit and conditions under which permit may be changed, revoked or under which it loses validity.

The mandatory documents to be attached to the application for permits of activities resulting in irradiation are of two types: those subject to approval, and other documents. The documents subject to approval include:

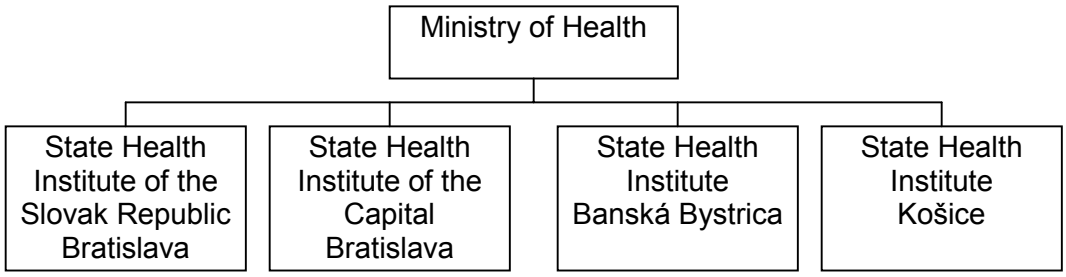
- radiation protection quality assurance,
- radiation protection programme,
- suggested definition of restricted zone,
- workplace monitoring plan,
- emergency plan.

Other documents include a list of background documents and documents used by the applicant to provide evidence of the meeting of the requirements concerning radiation protection and safe operation of the nuclear facility.

3.1.4.2 Regulatory Authority

The regulatory authority in charge of health protection against radiation in the Slovak Republic are the State Health Institutes , pursuant to the provisions of Act No. 470/2000 Coll.LL. on public health protection, as amended. The bodies of the State health regulator for protection against radiation include Chief Hygienist and the corresponding State Regional Hygienists. With respect to health supervision in nuclear facilities, the responsible body is the Chief Hygienist.

Fig. 3.1.4.2 Structure of state regulatory authorities in the field of health protection against radiation



3.1.4.3 Scope of responsibilities of the regulatory authority

In terms of the provisions of the Act mentioned, with respect to nuclear installations, the Chief Hygienist:

a) grants permits for:

1. commissioning of nuclear reactors – physical start-up,
2. permanent operation of nuclear reactors,
3. performance of maintenance and repair works on nuclear reactors,
4. structural and technological changes,
5. transport of radioactive sources,
6. cancellation of workplaces containing nuclear reactor (final removal of radiation sources and of radioactive contamination),
7. release of radioactive substances into the environment, while setting limits for radioactive emissions and liquid discharges,

b) approves selected documents and of restricted zones,

c) issues opinions on:

1. construction and structural and technological changes during construction relevant from the aspect of radiation protection,
2. the individual steps of commissioning,
3. the individual steps of decommissioning and on structural and technological changes during decommissioning relevant from the aspect of radiation protection,
4. physical planning documents in connection with the location of nuclear reactors,
5. suggestions to set hygienic protection zones,

d) issues instructions concerning the elimination of shortcomings identified,

e) establishes commissions to review professional competence for activities resulting in irradiation,

f) imposes sanctions.

Moreover, the Chief Hygienist grants permits for activities relevant from the aspect of radiation protection:

- for personal dosimetry,
- for monitoring of the general and working environment,
- for the performance of professional training for performance of activities.

Permits issued by Hygienist General of activities resulting in irradiation and concerning nuclear facilities are not final licences granted; they nevertheless represent the precondition for licence to be granted by the state administration authority of jurisdiction.

3.1.4.4 Exercise of state regulatory activities

Regulatory activities connected with radiation protection in nuclear facilities are the responsibility of the Department for Health Protection Against Irradiation at the State Health Institute of the Slovak Republic. This Department is in charge of checking the provision for radiation protection of the staff of nuclear facilities and also of the provision for radiation protection of the population in areas adjacent to the facility. The act referred to regulates the responsibilities of licence holders with respect to the provision of information and with the enabling of the exercise of state regulatory activities, and also sets authorisations of persons exercising the regulatory activities. More details concerning the activities of the division in charge of the regulation may be found in Section 4.6.4.

3.2 Operatorś responsibilities

3.2.1 Act No. 130/1998 Coll.LL. – Operatorś responsibilities with respect to regulation

See National Report as of September 1998.

3.2.2 Regulatory methods to verify operatorś compliance with license conditions

3.2.2.1 Inspections

The tasks in the field of state regulatory activities are fulfilled by ÚJD´s nuclear safety inspectors. In fulfilling their tasks in the field of state regulation, the nuclear safety inspectors follow ÚJD´s directive Inspection Activities. The Directive sets a uniform procedure for inspections, for the processing and evaluation of annual inspection plans, management of ÚJD´s inspection program, processing of documentation of inspection activities, and for analysis of ÚJD´s inspection activities.

The inspection plan is a tool for continuous and systemic evaluation of inspection activities at nuclear installations, as well as during transportation and controls of nuclear materials. As a rule, such plans are developed for the period of one year.

The plan comprises the following sections: (1) Operation and decommissioning of nuclear installations (NI), (2) Care of NI equipment, (3) Technical support to NI, (4) VÚJE, (5) Transports of nuclear materials, (6) Control of, and accounting for nuclear materials, and (7) Controls of other licence holders.

Inspections follow inspection procedures that are part of the ÚJD´s Inspection Manual. Individual inspection procedures are developed for inspection activities for which no inspection procedures have been developed.

Types of inspections

In general, planned and non-planned inspections are distinguished; this represents the first level of classification. The second level recognizes routine, special and team inspections for both planned and non-planned ones.

Planned inspections:

Routine inspections are intended to verify the provisions for the compliance with requirements and conditions of nuclear safety, condition of the NI, compliance with approved limits and conditions and with selected operating regulations. Routine inspections are performed mainly by resident inspectors at the corresponding NI. If it comes to inspections that, by their focus, go beyond the professional competence of the resident inspectors, inspections will be performed by nuclear safety inspectors from different Divisions of ÚJD. Routine inspections follow the procedures included in the Inspection Manual.

Special inspections are performed by nuclear safety inspectors in accordance with the basic inspection plan. Special inspections focus on specific areas, in particular on the verification of the compliance with requirements and conditions of regulations pursuant to § 32 of Act No. 130/1998 Coll.LL.

Special inspections as a rule follow procedures contained in Inspection Manual.

Team inspections focus on the compliance with requirements and conditions set by ÚJD pursuant to § 32 of Act No. 130/1998 Coll.LL., as a rule within several areas in parallel. Team inspections are planned for areas selected based on long-term assessment of operator´s results based on inspection activities and analyses. Team inspections mean inspections on which several departments participate.

Non-planned inspections:

Non-planned inspections are performed by nuclear safety inspectors as routine, special or team inspections. Such inspections are triggered by conditions prevailing at the NI (e.g. start-up stages) or by events at the NI. ÚJD uses them to respond to situations that have occurred at the NI.

Rules applicable to any type of inspections

Principally, inspections are announced in advance to the entity subject of supervision. However, they do not need be notified in advance if their focus and nature requires to do so.

Inspections of NI are notified in advance to the corresponding resident inspector. As a rule, resident inspectors participate in the inspections.

Any inspection performed by more than a single inspector has a head of inspection team appointed.

Inspection protocol.

Any inspection performed must be documented in the form of a protocol. Binding instructions concerning the remedial measures to be taken to eliminate shortcomings identified are recorded in the protocol. They have to be formulated clearly so as to impose the responsibility to eliminate shortcomings identified and to set clear and unambiguous deadlines for performance.

Analysis of inspection activities

Analysis of inspection activities comprises statistical evaluation of the findings. The objective of the statistical evaluation is to determine the distribution and the frequencies of inspection findings. Based on the evaluation of the developmental trends of inspection findings inspection plans for the period to come can be modified, to focus in particular on those areas where most shortcomings have been identified with respect to the entity subject to supervision .

3.2.2.2 Sanctions

See National Report as of September 1998.

4. General safety aspects

4.1 Priority to safety

4.1.1 Nuclear safety principles and definition

See National Report as of September 1998.

4.1.2 Nuclear and radiation safety concept

See National Report as of September 1998.

4.1.3 Role of the regulatory authority

Pursuant to § 4 of Act No. 130/1998 Coll.LL., ÚJD is authorized to grant licenses for doing business or use nuclear energy. §5 of the same Act defines conditions to be met for such a license to be granted. Paragraph 1(i) provides that the conditions also include legal competence, integrity character and reliability of the statutory body or its members, as well as professional competence. Based on this provision, ÚJD requires the applicants for license to meet the following:

1. to take the appropriate steps by the operator's management to provide for all organizational units involved in activities directly connected with the nuclear facility complying with the policy deeming nuclear safety a priority,
2. to respect the division of competencies so that the license holder has the primary responsibility for safety of the nuclear facility. Any changes in competences split between the license holder and NPP must be submitted to ÚJD for approval,
3. a separate nuclear safety department within the license holder's organizational structure must be established to be responsible for the fulfillment of tasks connected with the coordination of nuclear safety. The scope of the department's activities has to be submitted to ÚJD. ÚJD must be informed about the appointment of the head of such a department as well as on any changes in the scope of its activities, at least one month prior to such changes or appointment taking effect,
4. ÚJD must be informed on any changes of license holder's management and of the branch plants responsible for nuclear safety, at least one month prior to such changes taking place.

With respect to professional competence Act No. 130/1998 Coll.LL. requires that for collective statutory bodies (in case of a Board of Directors of a shareholding company, such competence must be demonstrated for at least one member, such member not necessarily being the chairman of the Board), at least one member must have university degree of the corresponding background (technical – faculty of mechanical engineering, faculty of electrical engineering, and/or faculty of natural science - nuclear physics, physics-chemistry) and three years of practical experience in the field. This means that such a person must have worked at least three years at a specific nuclear facility filling a position that is directly

connected with his/her qualification, and – as far as practicable – with the managerial position at a certain level of management (pursuant to § 13 of Act No. 130/1998 Coll.LL., the most important group of nuclear installations comprise of nuclear power plants).

4.2 Financial and human resources

4.2.1 Financing of operations and safety improvement programs

Among the principles of the Nuclear and Radiation Safety Concept adopted by the Board of Slovenské elektrárne a.s. is the commitment to spend the necessary funds to meet the main principles of nuclear and radiation safety policies and to provide for continuous training and improvement of qualification of the staff. To fulfill this commitment, it was necessary to develop a financial strategy plan to enable , among the tasks mentioned, to also fulfill also the production and technological development program.

The financial strategy of the company has been defined as a way to provide for optimum financing of operating and investment needs of the company. The strategic goals of the operator with respect to the finances include:

- preservation of a financially sound company,
- raising long-term funds that correspond to the service life of power sector projects,
- gaining the trust of banks and financial institutions.

Gaining the trust of banks and financial institutions is a long-term process that requires ongoing thorough analyses of achieve economical results, analyses of the environment within which the company is doing business (market position, market stability, development and provision for supplies and sales), and preparation of a transparent projection of future economical means. For the Joint Stock Company Slovenské elektrárne it was the period between 1994 and 1995 when it was spending efforts to gain this trust; several dozens of its employees were directly or indirectly involved in the development and presentation of background materials. Results appeared during the subsequent years when they succeeded in providing for sufficient funds to complete the construction and to implement safety relevant measures at NPP Mochovce, to reconstruct and upgrade NPP V-1 and V-2 units, but also to implement environmental projects connected with the upgrading of conventional thermal sources of the company.

The following may be mentioned as the most significant outcomes:

- 12/95 – issue of bonds at Slovenská sporiteľňa,
- 3/96 – restructuring of loans from Investičná a rozvojová banka,
- 5/96 – package of loans for the completion of construction of NPP Mochovce,
- 6/96 - 3-year revolving loan from a Slovak consortium of banks (VÚB),
- 7/96 - 3-year syndicated loan from JP Morgan,
- 11/96 – loan from European Investment Bank,
- 12/96 – issue of bonds at Slovenská sporiteľňa,
- 3/97 – loan led by Bank of America and Sumitomo Bank,
- gradual reduction of interest rates and extension of the tenure, with guarantees provided on behalf of the company only, without government guarantees, without retention rights or without issuing Bills of Exchange or other form of collateralization,

- rating agencies Standars & Poor`s and Moody`s Investments granted to the company economic rating at the sovereign rating level.

In this way, SE, a.s. could provide for transactions in a summary financial volume exceeding Sk 50 bn; loan restructuring improved the balance sheet structure, and reduced the average interest rates from the original 14.3% down to 11.6%.

Funds obtained from company's own profits and funds obtained from the above mentioned financial transactions enabled to implement, in addition to current repairs of nuclear facilities, also demanding projects of safety improvements at existing as well as newly constructed nuclear installations. During the preceding period, Slovenské elektrárne, a.s. invested:

- Sk 2 bn (USD 67 m) - „Small Reconstruction " project for NPP V-1units,
- Sk 8.6 bn (USD 245 m) – „Gradual Reconstruction " project for NPP V-1 units
- Sk 55.416 bn – construction of NPP Mochovce units 1 and 2, including the implementation of safety measures and physical protection system.

4.2.2 Financial sources for decommissioning and RAW disposal and treatment programs

Act No. 254/1994 Coll.LL. established, (effective of 1 January, 1995), State Fund for Decommissioning of Nuclear Power Generating Installations and Treatment of Spent Nuclear Fuel and Radioactive Wastes (SNIDF). By 1 April 2000 Act No. 78/2000 Coll.LL. became effective, that amended and supplemented Act No. 254/1994 Coll.LL. The main objective of the amendment to the Act was to extend the options of using the Fund.

The Fund is managed by the Ministry of Economy of the Slovak Republic, and its funds are kept on a special account of the National Bank of Slovakia. The Fund is generated from the following sources:

- contributions of owners of power generating nuclear facilities,
- sanctions imposed by ÚJD upon natural persons and legal entities pursuant to a separate regulation,
- bank loans,
- interest for the funds deposited at the bank,
- subsidies from State Budget,
- other sources.

Contributions of owners of power generating nuclear facilities represent the principal source of the Fund. In accordance with the provisions of the Act, the operator of power generating nuclear facilities, Slovenské elektrárne, a.s. is responsible to make payments to SNIDF in amounts equal to 10% of all revenues from sales of electric energy generated from nuclear sources. The revenues of SNIDF amounted to Sk 8.995 bn within 1995 through the end of 2000. The operatorś contribution in 2000 and government subsidy being Sk 2.3 bn and Sk 60 mil. respectively.

The Fund may be extended as earmarked subsidy to owners of power generating nuclear installation to owners of spent nuclear fuel and radioactive wastes repository, to persons authorized to treat radioactive waste whose generator is unknown, or to municipalities within the area at risk by nuclear installation, based on written application containing technical and economical reasoning . Money from the Fund may be used for:

a) decommissioning of nuclear installations,

b) treatment and conditioning of spent nuclear fuel and radioactive wastes following the closure of nuclear installation,

c) treatment of radioactive waste whose generator is unknown,

d) payments towards the protection of health and life of the population, protection and development of the environment in municipalities in areas at risk by nuclear installations, at 1% of the sale price of electricity generated in nuclear power plants for every area at risk by nuclear installation,

e) acquisition of land to establish radioactive wastes and spent nuclear fuel repository,

f) expenditures connected with the activities of the Fund, up to 0.3% of the Fund revenues,

g) research and development in the field of decommissioning of nuclear installations and treatment of spent nuclear fuel and radioactive waste after decommissioning of the nuclear installation .

SE, a.s. presently stores all spent fuel from Bohunice WWER units at the interim spent fuel storage facility (ISFSF) at SE-VYZ – at the Bohunice site. ISFSF was upgraded to increase its storage capacity and seismic resistance. The capacity was gradually increased by replacing original containers for new ones, and is sufficient to store all spent nuclear fuel generated during the operation of NPP Bohunice V-1 and NPP Bohunice V-2 units. The replacement is expected to be completed by 2007, and a new monitoring system is expected to be in place by the same time. Improvement of seismic resistance of the structural and technological parts followed the project in 1999. The planned costs of the whole project financed from SNIDF amounted to approx. Sk 2.8 bn.

4.2.3 Human resources

High quality human resources represent the principal precondition for a safe, reliable and environmentally friendly operation of nuclear installations. „High quality of human resources“ are understood as a set of professional, health-related and mental capacities of the staff to perform working activities at nuclear installations. From the aspect of working activities and their impacts on nuclear safety, NPP staff are classified into two basic groups:

- employees which have direct impact on nuclear safety – selected employees whose special professional competence has been verified (theoretical , written and oral exam and practical examination) by an examining commission established by ÚJD, and to whom a Special Professional Competence Certificate was issued Special,
- employees with impact on nuclear safety – professionally competent employees whose professional competence has been verified by an examination commission established by authorized specialized facility, by written and oral examination, and to whom a Professional Competence authorization was issued .

Pursuant to Act No.130/1998 Coll.LL. on peaceful uses of nuclear energy, special competence of employees means a set of professional knowledge, skills, practical experience, knowledge of the generally binding regulations and regulations issued by operator that represent a nuclear safety-related precondition to secure safe operation of NI, to prevent uncontrolled fission chain reaction, to prevent of not allowed

discharge of radioactive substances or ionizing radiation into the working environment or into the general environment, and to minimize the consequences of accidents and incidents.

Professional competence of staff means a set of knowledge and skills, attitudes and habits required to be allowed to perform certain activities/works, as verified by authorized body.

The liability for the overall working (professional, health-related and mental) competencies of the staff to perform working activities at nuclear installations remains with the operator. Operator appoints only employees competent to work, and to perform working activities. To every selected and professionally competent employee is issued „Authorization to Perform Corresponding Working Activities“ as part of the nuclear facility quality assurance. The authorization to perform working activities is issued for positions of selected employees with valid certificates of special professional competence for a given type of NI and for positions of professionally competent employees holders of authorizations for the given NI. The authorization represents a document evidencing the working competence of the employee with respect to regulatory bodies.

The organizational structure contains defined requirements with respect to working competencies to perform working activities for every position, i.e. education, professional, health-related and/or mental capacities and the prescribed types of training. The immediate supervisor of the employee is responsible for meeting of these requirements.

Training – acquisition and maintenance – as well as development of working competencies of the employees (knowledge, skills and attitudes) is managed at the individual NI by „Human Resources Training“ departments according to adopted and regulator-approved System of Staff Training.

The NI System of Staff Training is maintained and improved based on operating experience, organizational changes undertaken, technical solutions (upgrading) of facility, requirements of regulatory bodies, audits, IAEA reviews and recommendations. It is backed by the necessary human, financial and material resources.

The training of the staff and third persons (third persons represent contractors) is being provided in accordance with documents of quality assurance programme set up and maintained in accordance with:

- generally binding legal regulations applicable in the Slovak Republic,
- IAEA regulations, recommendations and guidelines,
- STN EN ISO 9001:1996 and 14001:1996 series standards,
- documentation of management within SE, a.s.´s Quality System.

With respect to the quality assurance system, the top document for the entire area of human resources is represented by the „Concept of SE, a.s.´s Human Resources Management“ with management documentation for human resources management developed based on it, including staff and management training and development at the SE, a.s.´s headquarters and at the individual NI.

The management documents set procedures and responsibilities for:

- selection and allocation of employees for positions,
- determination of the content and extent of training, education and development of the staff,
- acquisition, maintenance and improvement of qualification – professional competence of the staff,
- staff development,

- acquisition and maintenance by third persons of general competencies,
- staff re-training.

Fig. 4.2.3. illustrates the system of staff training in place.

With respect to their allocation to basic training, employees are divided according to activities performed by them into six categories that are further subdivided into occupational groups and subgroups according to the occupational orientation:

category 1- specified are employees with university diploma who perform working activities with direct impact on nuclear safety (primary circuit operator, reactor secondary circuit operator, head of reactor unit , shift supervisor , reactor physicist, etc.). Their professional competence is verified by an examination before a commission established by ÚJD that issues them Certificate of Special Professional Competence. The certificate is valid for two years. Prior to the elapsing of this period of time, the employee has to repeatedly pass the exam before ÚJD´s examination commission in full extent, to have his/her Certificate renewed for an additional period of two years.

category 2 – technical and economical staff of operating, maintenance and technical departments with university diploma or secondary education completed – they comprise heads of sections, departments, divisions, head masters, masters as well as employees involved in operation or maintenance of equipment.

category 3 – operating shift and operating staff, including employees involved in operating activities at technological equipment.

category 4 – employees involved in maintenance (with the exception of engineers) – employees involved in maintenance activities at technological equipment.

category 5 – employees in charge of NI decommissioning and handling RAW and spent nuclear fuel.

category 6 – other employees .

Employees on positions hierarchically superior to specified employees, such as vice-director for operations, chief engineer, head of operation control department, head of nuclear safety department, and head of reactor physics department, must hold university diploma in the field of technology / natural sciences – physics, and must have their special professional competence verified, no further verification of the competence is required.

Facilities for staff training

The basic training for NI staff as well as those of organisations performing special activities at NI is running at specialized training centers that are holders of authorizations to perform specialized professional training of NI staff granted by ÚJD upon such organisations meeting technical conditions and having verified the professional competence of their employees performing the training. The professional training is delivered in accordance with approved training programs.

Training delivery

a) Introductory briefing and training of employees are delivered by the individual NI.

b) Basic training:

- basic briefing and training – repeated Category I training,
- Category I re-training,
- general training of third persons,

are delivered by specialized training establishment, holder of the corresponding authorization for such activities. VÚJE delivers basic and theoretical training, basic and repeated simulator-based training of nuclear installation staff (with the exception of SE-EMO), while the individual nuclear power plants delivering stays, in-service training and periodical professional training of the staff.

Simulator training is delivered:

- at multi functional the full-scope WWER-440/V 213 simulator for SE-EMO, that emulates all standard and non-standard operating states of the nuclear power plant. The training equipment is a true replica of the NPP Mochovce unit 1 control room. It was built in accordance with the most recent US standards for staff training and technical safeguards by the companies S3 Technology and Sidemen's in cooperation with SE, a.s. experts,
- at the multi functional and full-scope WWER-440/V 213 simulator for SE-EBO, units 3 and 4 at VÚJE,
- at multi-functional and full-scope WWER-440/V-230 simulator for SE-EBO, units 1 and 2 at VÚJE. A multifunctional simulator for WWER-440/V-230 units developed under PHARE-TACIS project by Corys-TESS, Siemens, Belgatom, Thomson and other subcontractors was commissioned in February 1998. Also, a full-range simulator has been in operation since 14 May, 2001.

c) Other types of training (training of welders, NDT etc.) are delivered by various training establishments or directly at NI operators, including SE-EBO, SE-EMO, SE-VYZ by internal or external lecturers.

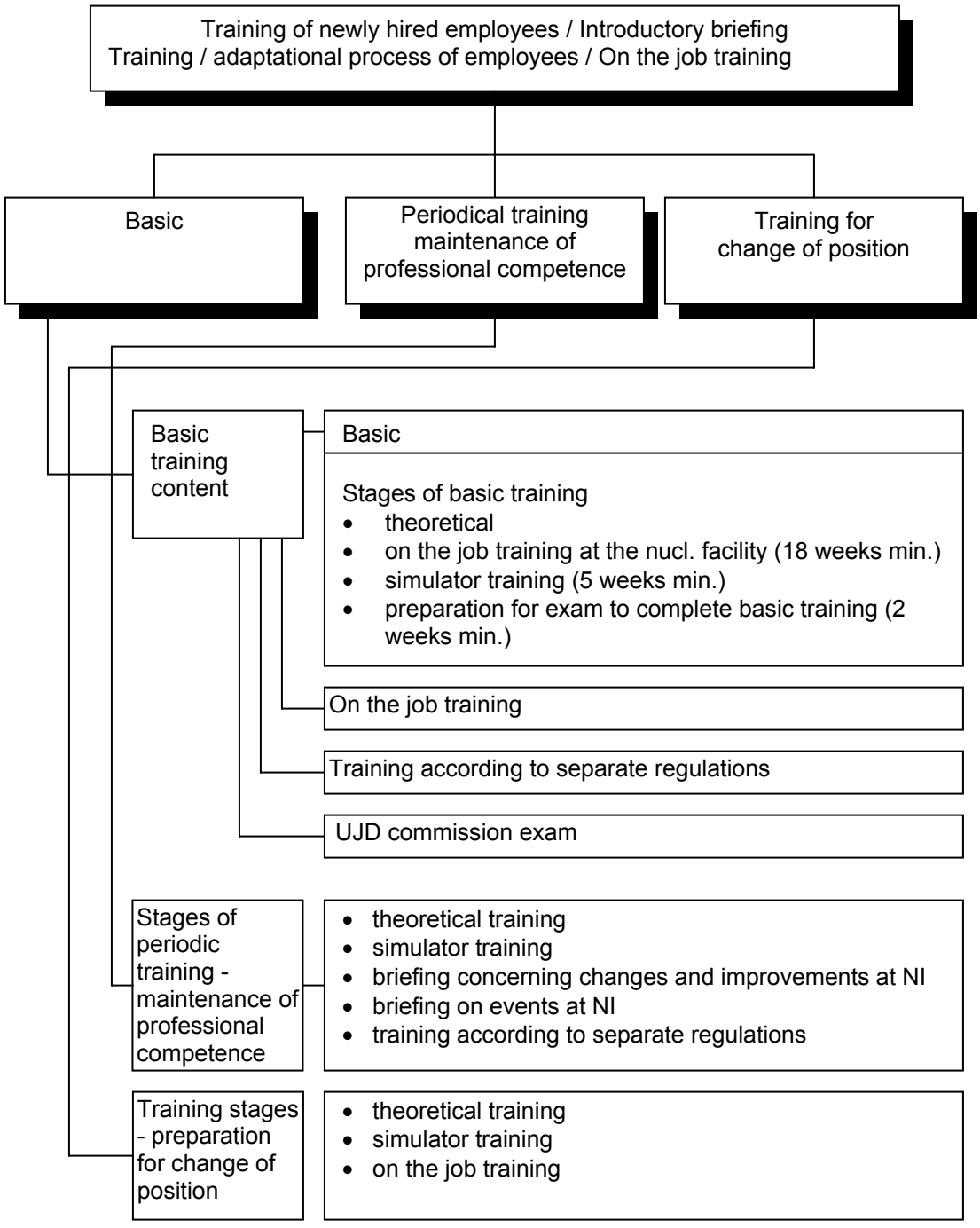
Training programs:

Basic training (theoretical training, simulator training, on-the job training) as well as periodical trainings of staff for the performance of nuclear safety relevant working activities at specialized establishments are delivered according to ÚJD approved programs based on suggestions of specialized establishments authorized to train specified employees.

Training programs have been developed for every category, professional group and subgroup of employees separately while accounting for types and stages of training. These set the objectives, content, duration of training, forms of learning and method of verifying upon knowledge.

An important element with respect to qualification upgrading of the employees has been cooperation with universities, in particular in the form of postgraduate and distance studies at the Slovak Technical University, University of Economics, and Commenius University, Bratislava.

Fig. 4.2.3 Stages, content and forms of training for specified employees



4.3 The human factor

4.3.1 Managerial and organizational measures

See National Report as of September 1998.

4.3.2 Methods to prevent human errors

See National Report as of September 1998.

4.3.3 Methods to detect and remedy human errors

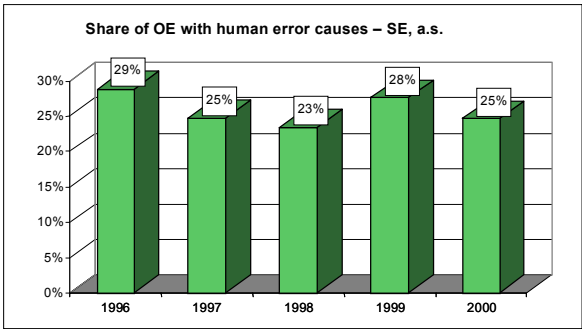
Disclosing of human errors, including root cause analysis and taking of measures to prevent them from repeating in the future is an integral part of the events investigation system at nuclear installation; event investigation feedback groups are established at divisions of power plant technical support. Section 5.3.5 provides a detailed description of the events investigation process at nuclear installations. Here, only some aspects concerning human factor are described.

The efficiency of the system is being evaluated and analyzed at regular intervals by feedback group staff. The results, along with draft measures and recommendations, are included in annual reports submitted to the power plant board for approval.

Safety culture and the human factor are also important components of a comprehensive reports on the status of the nuclear and radiation safety of SE, a.s., regularly presented to the company board.

In 2000, SE, a.s. recorded a total of 49 (25% of the overall number) NIE, where human error was one of the causes, thereof 15 and 32 events at nuclear installations due to the human factor at NPP Bohunice and Mochovce units, respectively. The higher numbers of events occurring at Mochovce were due to mainly poorer operating experience of the staff (a new power plant).

Fig. 4.3.1 Share of operating events with human error causes - overall SE, a.s.



On the average, the human factorś contributions is about 26% of NIE in all the three branch plants of SE, a.s. within the recent five years, thereof about one quarter of the events being due to the staff of contractors and/or external substations.

It is evident from Figure 4.3.1 that the share of staff's errors has been stable in recent years. The power plant staff are being briefed on a regular basis on the investigation results of NIE causes and their analyses. Moreover, such information are also available on the company's computer networks.

To improve the safety culture and for the purposes of self-assessment, individual branch plants develop so-called action plans of safety culture, evaluated annually and presented to the boards of the branch

plants for approval. Action plans are issued as Director Orders, they thus are of generally binding nature within the corresponding branch plant. Safety culture parameters have been defined for the purposes of evaluation.

A special group for self-assessment of safety culture was established at NPP Mochovce . The objective is to make the system of self-assessment more effective based on a survey within employees. The aim is besides existing instruments (newspapers, training, program STAR) for safety culture improvements to provide managers at all levels with an instrument for assessing the level of safety culture. For this purpose a set of indicators and rules for their application have been developed.

To prevent human errors, so-called program SAKO was put in place at NPP Bohunice (an analogy of the world-wide known program STAR – i.e. Stop, Think, Act, Review). The program is of a rather illustrative nature, with a fire-fly called SAMKO as logo; fliers, stickers, articles in company's magazine, etc. are used.

4.3.4 Role of the regulator

Pursuant to Act No. 130/1998 Coll.LL., activities with direct impact of nuclear safety may only be performed by specified employees whose special professional competence has been verified by ÚJD that issued them Certificate of Special Professional Competence. Specific working activities of professionally competent employees as well as of specified employees, methods, terms and conditions of the verification of the special professional competence as well as the prescribed training of employees are laid down by ÚJD Regulation No. 187/1999 Coll.LL.

Pursuant to the above mentioned Act, ÚJD sets the method, terms and conditions of the verification of special professional competence of selected employees and the method of granting of licenses to specialized institutions; ÚJD approves curricula and the method of training of selected employees.

ÚJD inspectors are authorized to verify upon professional competence of selected employees and withdraw Certificates of Special Professional Competence.

Requirements on provision for nuclear safety of nuclear installations upon start up and during operation are laid down by Act No. 130/1998 Coll.LL. and ČSKAE Decree No. 6/1980. The Decree deals with employees of nuclear installations and with requirements on qualification of the employees. ÚJD supervises the overall training of the employees, and verifies upon the qualification of selected categories of employees whose activities may directly impact nuclear safety.

ÚJD Chairman appoints members of examination commission that verifies special professional competence of selected employees. The examination comprises written and oral part and also practical part for those whose working position is to be changed. If the exams are successfully passed, Certificate may be issued. ÚJD keeps records of all applications for examination, including copies of the protocols on the completion of the basic training, being a necessary precondition for a Certificate to be issued. Also, ÚJD keeps records of all Certificates issued, and keeps updated lists of valid Certificates.

The second group of employees of nuclear installations are those with impact on nuclear safety. They have to pass examinations at an examination commission established at specialized institution . If the examination is passed successfully, the specialized institution issues Certificate of Professional Competence. For this group of employees, ÚJD also approves training programs for all parts of the basic

training, as well as post-training programs upon an employee going to work at a different NPP type. ÚJD at the same time supervises their compliance.

Supervisory activities under Act No. 130/1998 Coll.LL. in the field of training of nuclear installations staff are subject to regular inspections. The inspection program is based on verifying upon the compliance with the requirements put on employees in terms of § 4 of ČSKAE Decree No. 6/1980 and pursuant to ÚJD Regulation No. 187/1999 Coll.LL. Within inspections, compliance with plans of training of NPP employees as approved by ÚJD is verified , along with the fulfilling of training programs according to approved training programs. Also, inspections verify the compliance with NPP guidelines containing requirements on education, professional training and mental capability of NPP employees. As part of inspections, archiving of documents on training of employees is verified upon.

Additional inspections focus on the system of repeated NPP staff trainings. Within the inspections, ÚJD reviews fulfillment of repeated training plans. During the inspection, also the system of document keeping and document archiving on repeated staff trainings is reviewed.

ÚJD uses inspections to inspect specialized institutions – holders of licenses pursuant to §4 (2. e) of Act No. 130/1998 Coll.LL. for professional training of employees of nuclear installations. Inspections focus on review of technical equipment and professional competence of employees of the specialized institution . Within inspections, organization and records of training of NPP employees are evaluated, along with the basic training documents, technical equipment of the specialized establishment and compliance with the qualification requirements on employees of specialized institution authorized to train selected NPP employees. If the results of inspection are positive, ÚJD renews the validity of the Licence of the specialized institution for training of employees of nuclear installations.

Review of technical equipment also includes licensing and review of simulator. Within the review of the technical equipment of simulator, parameters and courses of input variables are verified upon, as well as random simulation of technological process according to chosen scenario. Documentation of all adjustments of simulator due to outcomes of tests and/or due to the implementation of technical solutions and design changes of units are verified. Under such reviews, technical and organizational provisions for simulator training are also verified , along with the professional competence of simulator training instructors. The teaching approach, orientation in the system of training, and correct evaluation of attendants are verified . The evaluation of simulator training instructors mentioned represents part of the verification of their professional competence by examination commission. If requirements are met and examinations are passed successfully, ÚJD issues authorization for training of selected NPP employees.

4.4 Operator´s quality assurance system

4.4.1 History of SE, a.s. Quality System establishment

Act No.130/1998 Coll.LL. provided as follows:

To provide for the quality of nuclear installations and activities with respect to all stages of the useful life of nuclear installations, from site selection to decommissioning of nuclear installations, license holders shall

be liable to create the necessary organizational structure, procedures and sources for identification and compliance with requirements with respect to quality of nuclear installations and their activities.

Requirements on quality systems and quality assurance are currently (until ÚJD Regulation is issued) contained in Decree No. 436/1990 Coll. of the former ČSKAE.

The Decree lays down requirements on quality assurance of equipment, machines, their components and materials, construction parts and structures, means of automated control of technological processes, including technical and software equipment, and systems of electric supplies relevant from the aspect of nuclear and radiation safety of nuclear installations, and sets the mandatory procedure for technical and organizational measures relevant to quality of specified facilities in the interest of the provision for nuclear safety of nuclear installations.

The principal requirements connected with the provision of quality of specified equipment include:

a) identification of activities relevant from the aspect of specified equipment,
b) organizational and technical conditions of quality assurance and all activities relevant for the quality of specified equipment,
c) development and approval of procedures for performance of activities relevant for the quality of specified equipment so as to reach and maintain the set standard of quality,
d) checking upon the extent and quality of activities performed relevant to the quality of specified equipment,
e) documenting of activities performed relevant to the quality of specified equipment, including inspection results,
f) evaluation of review results according to paragraph d) above and evaluation of the efficiency of measures taken.

4.4.2 The quality concept

See National Report as of September 1998.

4.4.2.1 SE, a.s.´s Quality System Structure according to company organisation structure

See National Report as of September 1998.

4.4.2.2 SE, a.s.´s Quality System structure by activities

See National Report as of September 1998.

4.4.3 SE, a.s.´s Quality System development and implementation project

The current license holder for the operation of nuclear installations is Slovenské elektárne, a.s. All the branch plants of SE, a.s. that operate NI have quality systems in place. The quality systems meet the requirements of Act No. 130/1998 Coll.LL., ČSKAE Decree No. 436/1990 Coll., as well as the applicable IAEA documents concerning nuclear safety.

In 1999 the maintenance division of SE-EBO received the certificate ISO 9001. The certificate was issued by the company Det Norske Veritas and is valid for production, reconstruction, repair, maintenance and assembly of equipment in nuclear and classical energy production and industry of selected pressurized equipment, etc. Det Norske Veritas guarantees for Slovak and foreign companies that the quality of work, which are performed by the maintenance division is certified by international norms of quality.

4.4.4 Verification of SE, a.s.´s Quality System

The efficiency of quality systems at nuclear power plants is reviewed by:

- internal audits conducted under quality systems,
- internal audits conducted by Slovenské elektárne, a.s., Headquarters,
- inspections conducted by ÚJD.

Any findings identified during the audits, inspections and reviews are subject to analyses at the corresponding level by the top management. Based on analyses, remedial and preventive measures are taken whose implementation is subject of controls. In this way, continuous improvement of SE, a.s.´s Quality System is achieved.

Audits of contractor's quality systems

SE, a.s. conducts audits of quality systems at contractors, checking upon the efficiency of the application of quality system requirements. The purpose of such audits is to secure good quality and reliable contractors with respect to safe, reliable, environmentally-friendly and efficient generation of electric energy and heat at SE, a.s.

4.4.5 Role of the regulator

Activities and tasks of ÚJD with respect to state regulator's role in relation to nuclear safety of nuclear installations in the field of quality assurance are laid down by Act No. 130/1998 Coll.LL. and by ČSKAE Decree No. 436/1990 Coll. The Decree lays down requirements and conditions of quality assurance with respect to specified equipment and nuclear safety of nuclear installations, sets basic requirements on quality assurance of selected equipment as well as the requirement concerning the development of quality assurance programs. ÚJD supervises the compliance on the part of responsible organizations with the requirements and conditions of quality assurance of specified equipment mentioned in the Decree and how such quality assurance programs are implemented. ÚJD as well as the responsible organizations – operators of nuclear installations, accept IAEA documents and, as far as practicable, use them to set their own requirements and procedures to secure nuclear safety and quality of selected equipment.

ÚJD´s philosophy in this area is based on the fact that, apart from the design of nuclear installations and several levels of interlinked protection barriers and appropriate technical and organizational measures, nuclear safety of nuclear installations is also provided for through required quality of selected equipment and corresponding activities. A quality system described by quality assurance program serves to maintain and develop quality.

ÚJD drafted a new regulation on quality assurance at nuclear installations. The regulation was subjected to intersectional commenting procedure, because of prevailing objections raised by National Labor

Inspectorate (NLI) , this Decree could not be enacted as yet. The discrepancies mainly reside in ÚJD´s and NLI´s competencies in the area of regulatory activities with respect to selected equipment at nuclear installations.

In exercising the regulatory role in the field of quality assurance, ÚJD has been focusing on two principal activities:

1. Approval of quality assurance programs

This is going on following levels:

a. reviewing, approving and control of quality assurance programs of responsible organizations and of partial programs of quality assurance for specific stages of nuclear installation's life set by such as design, construction, start up, operation, decommissioning, etc.,

b. reviewing, approving and control of individual quality assurance programs developed for the individual selected equipment or group of selected equipment in accordance with their category with respect to their relevance for nuclear safety,

c. reviewing and control of quality systems of certificate holders for activities in the peaceful uses of nuclear energy (with the exception of developer and operator), in particular of contractor organizations.

2. Inspections of the implementation of quality assurance programs

Inspections in the field of quality assurance are used by ÚJD inspectors to verify compliance, on the part of responsible organization, with the requirements of ČSKAE Decree No. 436/1990 Coll., conditions shown in ÚJD decisions, and how they implement the approved documents of quality assurance. Following the approval of the corresponding program, the control (inspection) activities of inspectors focus upon verifying the fulfillment of the individual requirements and practical implementation of requirements, i.e. accordance between approved documented procedures and actual activities. Nuclear safety inspectors draft protocols on inspections performed, and discuss them with heads of the responsible organizations. Any discrepancies identified concerning specified equipment, activities or documentation, may be followed by measures imposed by the inspector to eliminate them. Inspections are performed according to approved program, they have their objectives and forms of documentation set.

Apart from the above activities, ÚJD is authorized to enforce measures and requirements contained in generally binding legal regulations or ÚJD requirements following from decisions or inspections. As part of this, meetings are organized with the responsible organization, inappropriate quality assurance programs get not approved, or extraordinary inspections are conducted; in extreme cases, sanctions may also be imposed.

4.5 Safety assessment and verification

4.5.1 Characterization of nuclear power plants in operation

The structure of the individual types of nuclear power plants in operation includes WWER-440 /V-230 reactor units (2 units at NPP Bohunice) and WWER-440/V-213 reactor units (2 units at NPP Bohunice and units at NPP Mochovce). Two WWER-440/V-213 units are under construction at Mochovce (their

construction was however frozen in mid-90s and the facility was preserved). The V-230 reactors are quite different from V-213 reactors as far as their structure and safety elements are concerned, whereas both types of V-213 reactors at NPP Bohunice and Mochovce are based on the same design concept. The V-213 reactors at NPP Mochovce showed a number of improvements in their original design, and also included some new safety elements. During the construction of NPP Mochovce, the safety standard of the original design was reassessed, and a number of safety relevant improvements was introduced.

In the framework of the extensive gradual reconstruction, the project base of WWER-440/V-230 units at Bohunice was significantly supplemented and upgraded, so that the units may presently be considered advanced type of the original WWER-440/V-230 project.

4.5.2 Safety assessment of nuclear power plants by regulator (ÚJD)

See National Report as of September 1998.

4.5.3 Basic principles of ÚJD issued decisions on safety improvements of nuclear power plants in operation

In Slovakia, similarly as in other countries, there are no officially encoded rules or requirements concerning safety improvements of nuclear reactors. The requirements of the regulator therefore are set specifically for the individual reactor types. Safety improvement programs are developed by operator of nuclear power plants that has primer responsibility for nuclear safety.

The safety concept of nuclear power plants in Slovakia is based on so-called „defense in in-depth concept“, a concept generally used world-wide upon designing and operating nuclear power plants. In reviewing safety of NPGI, ÚJD reviews the ability of the facility to fulfill safety functions in terms of the design to provide for the required standard of defense in-depth.

The process of safety improvements follows the current international safety standards. Some specific measures were taken based on comparisons of some national standards with those applicable in developed countries. As a rule with respect to WWER-440 reactors, measures to improve safety are generally oriented towards improving reliability, redundancy (in particular with respect to V-230 reactors), and physical separation of safety systems.

The list of safety related shortcomings the solution ,of which is contained in the safety improvement programs for specific reactor types, has been the result of the recent developments in the field of primary circuit integrity, evaluation of events at nuclear installations, results of BDBA analyses, etc.

ÚJD is using deterministic approach to efficient management of the process of safety improvement, in particular to improve the safety of safety systems (independence, redundancy). PSA for specific reactor is used to set priorities for individual measures to improve safety, above all those that make the most significant contribution to core damage.

Requirements on safety improvement are partly set with respect to accident probability. Acceptance criteria for accident analyses set by ÚJD are generally expressed as acceptable radiological consequences that differ according to the probability of the initiating event. Moreover, conservative or so-

called best-estimate procedures for accident analyses have been prescribed. Best-estimate procedures are only accepted for accidents with a very low probability of occurrence (less than 10^{-6}).

Another principle used by ÚJD in the process of safety improvement is limitation of the duration of operation of nuclear power plant units through granting approvals for a limited period of time, which enables a management of the safety measures implementation process. This approach has so far been applied to units with type V-230 reactors at NPP Bohunice.

Based on previous experience, ÚJD set probability targets of acceptability at systemic level for safety systems, for the reactor protection system, for core damage, for so-called early release of radioactive substances, as well as exclusion criterion for external initiating events of emergency sequences.

4.5.4 ÚJD requirements for WWER-440/V-230 NPP V-1 safety improvement

For a historical overview concerning the requirements on safety improvement of WWER-440/V-230 reactors at Bohunice, see National Report , September 1998.

Gradual reconstruction of NPP V-1 was completed in 2000, thus fulfilling ÚJD Decision No. 1/94. Review of the Safety Analyses Report after gradual reconstruction of NPP V-1 started in early 2000 based on nuclear authority's comments. Based on the safety report review and having incorporated the comments as well as of the results of an in-depth inspection, ÚJD is about to issue a decision granting the approval of NPP V-1 operation with conditions shown in the annex to the decision (as of 1 July 2001).

4.5.5 ÚJD requirements for WWER-440/V-213 NPP V-2 safety improvement

For a historical overview concerning requirements on safety improvement of WWER-440/V-213 reactors at Bohunice, see National Report, September 1998.

In 2000, ÚJD reviewed the document „Safety Concept of the Upgrading and Safety Improvement for NPP V-2" presented by SE, a.s., the operator of the power plant. Having reviewed the document, ÚJD issued Decision No. 214/2000 instructing the operator to develop terms of reference for the individual measures contained in the Concept, including an implementation time schedule, so as to implement the individual measures depending on their category gradually by 2008. The principal measures whose implementation was imposed by Decision No. 214/2000 were taken by the operator in June 2001, who presented the document „Account of the Implementation of Recommendations on Safety Related Issues of NPP WWER440, model 213 from IAEA document EBP-WWER-03, and their Actual Status for NPP Bohunice units 3 and 4 .

4.5.6 ÚJD requirements for safety improvement of WWER-440/V-213 at NPP Mochovce

For a historical overview of the requirements on safety improvement of WWER-440/V-213 reactors at Mochovce, see National Report, September 1998.

In meeting ÚJD requirements, NPP Mochovce unit 1 was commissioned in 1998, and unit 2 of NPP Mochovce was commissioned in 1999–2000 while complying with start up stages and enhanced emphasis on the implementation of safety measures.

The extent and the time schedule of the implementation of safety measures at NPP Mochovce was presented to ÚJD for review on 29 November, 1999. In December, ÚJD issued Decision No. 433/99 that set new dates for, and the extent of the implementation of safety measures.

Approval of NPP Mochovce unit 2 operation was granted by ÚJD by Decision No. 84/2000 setting, a.o. requirements on dates and the method of implementation of safety measures that had not been completed at the time of the unit start up. The current status of the implementation of safety measures is described in Chapter 2.3.3.3.

4.5.7 ÚJD requirements for periodic safety reviews

As a result of periodic safety reviews of V-230 and V-213 reactors in operation requested by ČSKAE and subsequently by ÚJD (1) setting of requirements on the completion of safety reports in a format as usual in developed countries, (2) setting of requirements on safety improvements of nuclear reactors, (3) setting of requirements on safety improvements of nuclear reactors under construction, and (4) setting of requirements on systematic periodic safety reviews for all nuclear reactors in Slovakia has been set. Presently, periodic safety reviews are conducted based on the IAEA safety guide 50-5G-012 and based on experience acquired in other countries. Based on „Atomic Act“ No. 130/1998 Coll.LL., ÚJD works on the draft of a regulation on „periodic nuclear safety review“ that will regulate intervals and the extent of comprehensive and systematic nuclear safety reviews during the operation of nuclear installations. By this the requirement for periodic safety review will get legal platform mandatory to all participants.

4.6 Radiation protection

4.6.1 Legislation in the field of radiation protection, and its implementation

The following are the principal legal regulations applicable to the protection against radiation:

- Act No. 272/1994 Coll.LL., as amended,
- Regulation No. 12/2001 Coll.LL. on requirements on securing radiation protection.

Act No. 272/1994 Coll.LL. on protection of public health, as amended by Act No.290/1996 Coll.LL. and Act No. 470/2000 Coll.LL., and Regulation No. 12/2001 Coll.LL. are based on the philosophy of the ICRP recommendation 60 of 1990, International Basic Safety Standards, SS No. 115 of 1996, and accounts also for the provisions of European Union Council directives and regulations in the field of radiation protection.

4.6.2 Implementation of radiation protection legislation

Act No. 272/1994 Coll.LL. as amended and the Decree No. 12/2001 Coll.LL. have implemented all the directives and regulations of Euratom Council concerning radiation protection at nuclear installations, including e.g.:

- Council Directive No. 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of the workers and the general public against the dangers arising from radiation,

- Council Directive No. 90/641/Euratom of 4 December 1990 on the operational protection of outside workers exposed to the risk of ionizing radiation during their activities in controlled areas,
- Council Regulation 89/618/Euratom of 27 November 1989 on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency,
- Council Regulation 87/3954/Euratom of 22 December 1987 as amended by Council Regulation 89/2218/Euratom of 18 July 1989, on the special conditions for exporting foodstuffs and feeding stuffs following a nuclear accident or any other case of radiological emergency,
- Council Regulation No. 90/770/Euratom of 29 March 1990, laying down maximum permitted levels of radioactive contamination of feeding stuffs following a nuclear accident or any other case of radiological emergency.

In the system of quality assurance of SE a.s. the implementation of the applicable laws has been projected into the „Basic Directive“ on radiation safety. The branch plants have the national legislation as well as recommendations of international commissions (ICRP and IEAEA) incorporated into directives and work procedures and set limits of irradiation of persons and discharge limits of radioactive substances into the air and waters.

Dose and irradiation limits for employees have been set for trimesters and yearly periods, with the set intervention limits per se being lower than those provided for by the legislation (upon the reaching of which the reasons for their having been exceeded are investigated, and must be justified).

Any works always account for the principles of radiation safety, in particular the ALARA principle, and the principle of dose and risk limiting.

Environmental discharge limits for radioactive substances are set by regulatory bodies. The purpose is to secure under normal as well as abnormal conditions that they do not cause effective doses set by the national legislation and international recommendations being exceeded for individuals from the population.

4.6.3 Monitoring of radiation situation by the operator

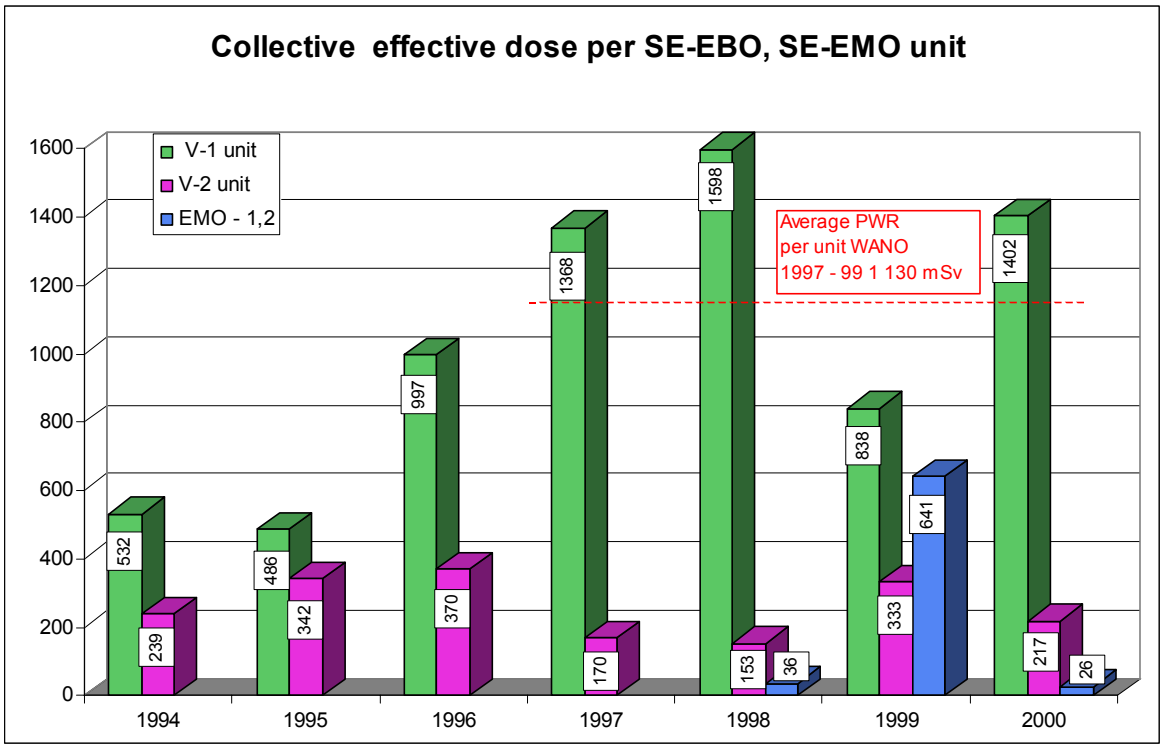
4.6.3.1 Radiation control at SE, a.s.´s nuclear installations

For the description, see National Report as of September 1998.

Fig. 4.6.3.1 shows the development of average collective effective dose per SE-EBO and SE-EMO unit for 1994 through 2000. In 2000, the collective effective dose per NPP V-1 unit was higher than the average CED value of 1130 man mSv achieved at PWR units in 1997-99 (according to WANO), due to the extensive scope of works during the completion of gradual upgrading. CED may be expected to drop in subsequent years to values achieved prior to the gradual upgrading. The values achieved at NPP B-2 and SE-EMO are rather low, and based on this parameter, these units are among the top 25% PWR units, since the value for these types of reactors was 720 man mSv in 1997-99.

There has been no case of irradiation limits being exceeded for any SE, a.s.´s employee or contractor for the said period. At SE, a.s.´s NI, CED values keep staying at a low average level, suggesting a rather good standard of its management through the application of the ALARA system.

Fig. 4.6.3.1 Average collective effective dose per SE-EBO and SE-EMO unit



4.6.3.2 Air and water emission control

Discharges into the air are continuously monitored using devices placed at ventilation stacks. These equipment continuously monitor the activity of gases, airborne particles and iodine. Moreover, samples of airborne particles are continuously taken for the determination of alpha nuclides and Sr 90.

Hydrosphere discharges are verified upon continuously to record deviations from normal conditions. For the purposes of accounting the control of activities in discharged waste waters is performed by measuring the activity of tritium and corrosion and fission products and of fission products of Strontium before the discharge of waste waters.

Limits of atmosphere and hydrosphere discharges of radioactive substances are given in the Annex – chapter 6.4.

The limits of atmospheric and hydrosphere discharges of radioactive substances for SE-EBO and SE-EMO set for 2000 are shown in Tables 4.6.3.2a.) and 4.6.3.2b.). It may be stated that in 2000 as well as in all the preceding years, the discharge limits for radioactive substances were not exceeded, with discharges of corrosion and fission products and atmospheric discharges deep below the authorized limits.

Table 4.6.3.2a.)

Atmospheric discharges in 2000			
Facility	**Discharge**	**Activity**	**Share on limit [%]**
NPP V-1	rare gases	9.29 TBq	0.,23
	aerosols	702.13 MBq	0.39
	iodine 131	673.18 MBq	1.0
NPP V-2	rare gases	5.36 TBq	0.13
	aerosols	11.59 MBq	0.006
	iodine 131	2.37 MBq	0.004
NPP MOCHOVCE	rare gases	14.41 TBq	0.35
	aerosols	10.91 MBq	0,.06
	iodine 131	56.53 MBq	0.08
ISFSF	β aerosols	25.3 MBq	8.44

Table 4.6.3.2b.)

Hydrospheric discharges in 2000			
Facility	**Discharge**	**Activity**	**Share on limit [%]**
Bohunice site	Corrosion & fission prod.	206.85 MBq	0.54
	tritium	13 421.55 GBq	30.71
NPP MOCHOVCE	Corrosion & fission prod.	58.40 MBq	5.31
	tritium	10487.00 GBq	87.39

4.6.3.3 Monitoring of environmental impacts

Being part of the radiation control of nuclear installations, also environmental impacts of the operation of nuclear power plants are assessed. Environmental impact assessment of the operation of nuclear power plants commences by pre-operation monitoring of radioactivity at the site considered for the construction of the nuclear power plant and in its surroundings. The series of values obtained serves to realistically compare environmental impacts of the operation of the power plant.

Prior to commissioning NPP Mochovce, a survey and analysis of the site were performed with the results included in the epidemiological survey entitled „Health Condition of the Population in the Area of the Nuclear Power Plant Mochovce" (1999). The study summarized the results of a detailed survey and assessment of an area with a diameter or up to 20 km, based on health indicators. The report provided an exhaustive description of the health condition of the population in the area, before start up of the NPP Mochovce as a document for assessing its impact on the environment.

Environmental impacts of the power generating nuclear installation are monitored and documented by Laboratory of Environmental Radiation Control. The scope of the monitoring is set by a monitoring program that at the same time sets minimum numbers and types of the media to be monitored. The media that are monitored for potential impacts of the power generating nuclear facility include air, water, soil and agricultural products as part of the food chain acting upon human beings. More than 1,150 samples are taken from the environment every year.

To improve the monitoring of impacts of nuclear installations on their immediate surroundings, a teledosimetric system was set up in the vicinity of NPP Bohunice. The teledosimetric system is computer controlled and allows samples of airborne particles, radio iodine to be taken, to determine the dose equivalent rates around the site, and meteorological data. Selected teledosimetric system-obtained data are on-line transmitted to ERC ÚJD.

Since the amounts of discharges into the air and water streams are small, to assess impacts of NPP Bohunice and NPP Mochovce upon the population in the area, dose burden to which the population is exposed is analyzed based on real discharges of radioactive substances in the respective years, accounting for the meteorological situation as monitored by SHMÚ meteorological station at Jaslovské Bohunice and Mochovce.

The analysis uses standardized software RDEBO and/or RDEMO that computes individual dose equivalents (IDE). The calculations suggest that the area with the highest level of effective dose equivalents spreads along the prevailing direction of winds. For Bohunice, it is direction S and SS at 3 – 5 km (the village of Malženice), and the critical age group are the 7 – 12-year-olds. For NPP Mochovce, the direction is SSE at 3 – 5 km (the village of Nový Tekov). The critical age group are infants.

Table 4.6.3.3a.) IDE calculated for population groups in the environment of NPP Bohunice

Year	IDE [Sv]		
	infants	7-12 years	adults
1998	1.64E-7	1.11E-7	6.61E-8
1999	6.63E-8	8.67E-8	8.29E-8
2000	1.49E-7	2.05E-7	1.92E-7

These IDE values are considerably lower than those received by the population from the natural background. The individual dose equivalent from the natural background around NPP Bohunice and NPP Mochovce is 100 - 10 000 times higher than the values shown in the tables. IDE calculations are characterized by principal conservatism, being thus markedly overestimated as compared to the actual situation, since estimates of input data, in particular of the consumption of food harvested within the region and of water, their effects on the result of the calculation of the radiological impact is complex.

The results of the calculations for the three most burdened population groups for both areas are shown in Tables 4.6.3.3a.) a 4.6.3.3b.)

In addition to the monitoring of the very nuclear installations, environmental impact assessment of the operation of nuclear installations is also taken care of by the regulatory bodies (SHI).

Table 4.6.3.3b.) IDE calculated for population groups in the environment of NPP Mochovce

Year	IDE [Sv] NPP Mochovce		
	infants	2-7 years	adults
1998	1.00E-7	8.60E-8	6.80E-8
1999	3.77E-7	2.79E-7	2.09E-7
2000	6.67E-7	4.85E-7	3.59E-7

The Center for Health Protection against Radiation performs monitoring of integral doses within the system of monitoring points in the environment of the NI using thermoluminescence dosimeters; it measures discontinued dose rates in the system of monitoring points in the NI environment, it monitors activities of corrosion and fission products in fallouts, airborne particles, drinking, surface and ground waters, in soil, sediments, agricultural products and food components

produced in the environment of the nuclear facility, it makes random parallel analyses of airborne particles in exhalations and samples from wastewater collection tanks prior to their being discharged.

Slovak Radiation Monitoring Network Center (SÚRMS) is a standing executive component of KRH that takes care of methodological support of monitoring network components and their uniform proceeding in monitoring radiation situation.

SÚRMS is established at Institute of Preventive and Clinical Medicine in Bratislava as part of the latter. SÚRMS head is appointed by KRH Chairman at the suggestion of Minister of Health.

In times where there is no radiation accident, SÚRMS directly reports to the Minister of Health.

SÚRMS is comprised of the following units that take part in the monitoring of radiation situation in Slovakia:

- Slovak Institute of Hydrometeorology's monitoring system,
- Monitoring system of the Army of the Slovak Republic,
- monitoring system of MV SAR – Office of CP,
- monitoring system of MZ SAR,
- monitoring systems of NPPs.

Results of direct measurements at constant monitoring stations, results of evaluation of samples from the environment and computed values from analyses of the impact on the population of discharges of radioactive substances suggest that although measurable, the impacts of the operation of reactors at NPP Bohunice and NPP Mochovce on the population and the environment are but negligible.

4.6.4 Activities of regulatory bodies

Persons exercising state regulatory activities in the field of health are in terms of the provisions of the corresponding legal instruments authorized to enter enterprises and premises, request information, take samples, investigate and inspect the corresponding documents. Upon exercising their activities, they verify the compliance with the generally binding legal act and regulations, conditions set in permits, measures imposed by the regulatory body .

Verification of radiation protection is secured by:

- system of information that operator continuously provides to the institution exercising the regulatory activities under conditions set in the permit to perform activities resulting in irradiation,
- on the spot inspections.

According to the purpose of inspections they ,as a rule, include monitoring of radiation situation in the working environment, in the surroundings of nuclear installations and in reference localities, using own means. The objective of the measurements is to objectively evaluate the impact of the NI operation on working and general environment.

Upon exercising state regulatory activities with respect to radiation protection, officers exercising the activities verifying mainly the following:

- radiation situation at the nuclear installation, while performing own measurements,

- compliance with approved documentation,
- dose-related burden of the staff, records of dose exposure of NI staff, with own analyses of the burden on the staff,
- monitoring of discharges, with random control measurements of some parameters of the radioactivity of discharges,
- application of optimization of radiation protection,
- professional and health-related capacity of employees, managing officials and professional representatives for radiation protection,
- documentation relevant for health protection against radiation,
- conditions of introducing into the environment of radioactive substances,
- preparedness of nuclear installations for radiation incidents and emergency situations,
- impact of the operation of nuclear installations on the environment and exposure of the population to doses, with performing own analyses of the radioactivity of environmental media,
- activities of environmental radiation control, etc.

Officials exercising the regulatory activities prepare, based on the findings, background documents for decisions of the health protection body in approving activities resulting in irradiation and in imposing measures, instructions or sanctions.

State health regulatory authority performs in working environment mainly monitoring of dose rates, of activities of airborne particles, surface contamination, and/or other special measurements. In the NI surroundings, monitoring of integral doses using TLD method and discontinuous measurements of dose rates are performed in the monitoring points system, as well as monitoring of the activities of corrosion and fission products in fallouts, airborne particles, drinking, surface and ground waters, soil, sediments, agricultural products and food components produced in the environment of the nuclear installation. At irregular intervals, also parallel analyses of airborne particles in exhalations and samples of wastewaters are performed.

4.7 Emergency preparedness

4.7.1 Emergency preparedness related legislation

For the time being, legislation applicable to emergency preparedness is based on acts and decrees of ministries with the largest share on emergency preparedness and emergency planning, in particular:

- Act No. 130/1998 Coll.LL. on peaceful use of nuclear energy
- Act No. 470/2000 Coll.LL. that amends and supplements Act No. 272/1994 Coll.LL. on public health protection, as amended,
- Act No. 42/1994 Coll.LL. on public protection as amended ,
- ÚJD Decree No. 245/1999 Coll.LL. on emergency planning for the case of incidents and accidents,

- Decree No. 300/1996 Coll.LL. on provision for protection of the population upon production, transportation, storage and handling of hazardous substances,
- Decree No. 12/2001 Coll.LL. on requirements for securing of radiation protection,
- MV SR, MZ SR and ÚJD Directive No. CP – 187/374/2000 that unifies the development and approval of population protection plans for the case of nuclear installation accidents.

All the above mentioned documents account for recommendations of the Vienna based International Atomic Energy Agency and the relevant European Union directives in the field of emergency preparedness, such as:

- Safety Series 50-SG-06: Operator preparedness for emergency situations at NI,
- Safety Series 50-SG-66: Preparedness of public administration bodies for emergency situation at NI,
- Safety Series 55: Planning of accident response in NI environment upon radiation accident at NI,
- Safety Series 72. Rev. 1: Protection of radioactivity sources not controlled upon accidents,
- TEC DOC 953 – Methods of emergency response preparation for nuclear and radiation accidents,
- TEC DOC 955 – Basic evaluation procedures for setting of protective measures for reactor accidents,
- 82/501/EHS: Council Directive of 24 June1982 concerning risks associated with severe accidents in certain industrial activities,
- 87/600/Euratom: Council Decision of 14 December 1987 on the setting up of a system of Community measures for rapid exchange of information in radiological emergencies,
- 89/618/Euratom: Council Directive of 27 November 1989 on information provided to general public on health protection measures that need to be applied and on steps to be undertaken upon radiological emergencies.

Moreover, Act on emergencies, and Act on integrated rescue system are being drafted.

4.7.2 Implementation of the emergency preparedness related legislation

4.7.2.1 The national organization of emergency preparedness

To secure measures necessary to cope with emergency states of nuclear installations and measures to protect the population and the economy upon accidents impacting upon the surroundings, the national organization of emergency preparedness (Fig. 4.7.2.1) is structured into three levels.

Level one comprises emergency commissions of nuclear installations whose main function include management of works and measures in the area of nuclear installations so as to enable the identification of the condition of the corresponding nuclear installation and to manage measures to cope with the emergency condition and to mitigate the consequences with respect to the staff, facility as well as consequences with respect to the environment and the population.

As an additional function at this level, information is to be provided to regional and district level commissions (Regional and District Commissions for Radiation Accidents - KKRH,OKRH) that provide information on the condition of the facility and potential environmental impacts.

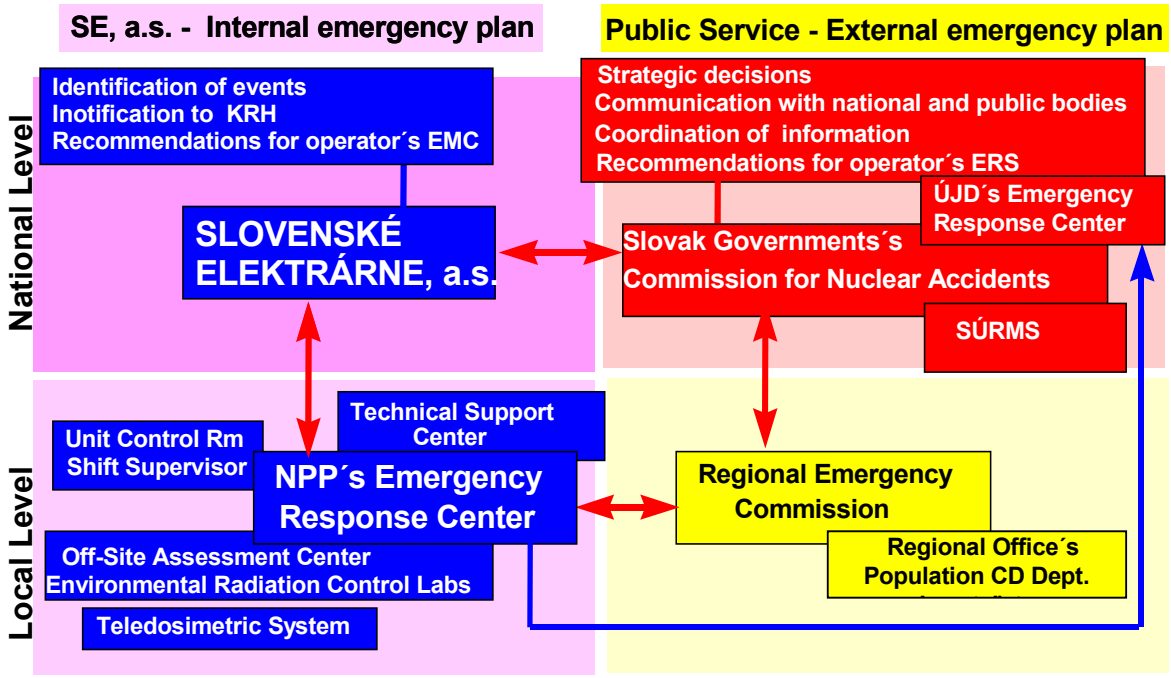
Level two is organized at the regional level and comprises Regional and District Commissions for Radiation Accidents of jurisdiction over territories at risk where life, health or property may be at risk, and where measures to protect the population are planned. Such territories comprise an area of 30 km in diameter around NPP Bohunice and 20 km around NPP Mochovce.

Level three comprises the National Emergency Commission of the Slovak Government for Radiation Accidents (KRH SR) with its respective expert supporting components (ERC ÚJD, OSG and SÚRMS). The Slovak Government's Commission for Radiation Accidents is mainly for coordinate and control preparation of measures oriented towards the protection against consequences of radiation events if the capacities and competencies of the Regional Emergency Commission for Radiation Accidents (KKRH) are exceeded.

As a part of this level, also SE a.s.´ s Failure Commission is established that closely cooperates with ERC ÚJD and KRH SR. The major role of the SE, a.s.´s Failure Commission is to organize and coordinate rapid elimination of consequences of severe and extraordinary events at the respective generating and distribution facilities/equipment.

- ERC ÚJD plays a role of technical for to monitoring the operation of NI and to evaluate the technical condition and the radiation situation in cases of nuclear or radiation accidents and to forecast the development of the accident in terms of Act No. 130/1998 Coll.LL. At the same time, it also serves as a means of technical support to OSG established within KRH SAR.
- OSG – Operating and steering group is an expert advisory body to KRH SR established based on bylaws and KRH SAR resolution. The role of OSG is to assess the situation upon NI accident and to develop background documents and a single common recommendation of all sectors involved concerning decision-making at the KRH SR level on measures to protect the population. In developing the recommendations, OSG closely cooperates with ERC ÚJD.
- SÚRMS – Slovak Center of the Radiation Monitoring Network represents a body or technical support established at MZ SR; it is the site to centrally collect and evaluate data from all radiation situation monitoring systems in the Slovak Republic. This body was established based on KRH SR resolution and its bylaws.

Fig. 4.7.2.1 Slovak Republic's National organization of emergency preparedness



4.7.2.2 Accident documentation

To manage emergency situations at nuclear installations and their impacts upon the surrounding environment, accident documentation has been developed to lay down procedures and organization of work for the individual degrees of emergency situations at various levels of the national emergency preparedness as described in section 4.7.2.1.

Operator of nuclear installations has on-site emergency plans in place, setting the organization of emergency response and its implementation concerning the management of emergency situations and staff protection, including protection of health of employees laid down in traumatological plan. Moreover, operating instructions are in place to enable identification and classification of an emergency event according to international recommendations. At the national level, emergency plans are developed, as well as emergency plans for ERC ÚJD and SE, a.s.´s Failure Commission.

The first draft of the National Emergency Plan is being currently developed that will summarize all procedures and measures of the individual members of the Slovak Government's Commission for Radiation Accidents. KRH SR is expected to approve this plan by the end of 2001, and the National Emergency Plan (NHP) will thus become binding upon KRH SR members. Off-site emergency plans in case of nuclear accident of a nuclear installation are developed at regional level for the area at risk, including measures to protect the population, health, property and environment, and are linked to internal emergency plan.

All the above mentioned plans fully apply the provisions of the national legislation as well as international recommendations by IAEA and European Union Directives mentioned in section 4.7.1.

4.7.3 Operator's on-site plans

On-site emergency plans and the related documents are developed so as to provide for the protection and preparation of the staff for the case of the occurrence of a significant leakage of radioactive substances into the working environment or the surroundings, and measures will have to be taken to protect the health of people at the level of the nuclear installation or of the population in adjacent areas.

In-site emergency plan mainly describes:

- the system of classification of events, evaluation procedures,
- the organization structure of emergency response and the responsibilities within it,
- the system of communication and warning of the population and of the NI staff,
- protective measures and method of their implementation,
- medical measures plan,
- principles of recovery,
- cooperating external organizations and bodies,
- the system of training of staff and members of emergency response organization,
- methods of educating and informing of the public. .

The aim is to provide for the activity of the emergency response organization (ERO), i.e. planning and preparation of organizational, personnel and material and technical means and measures to successfully manage crisis and emergency situations according to the classification of the event. ERO comprises the following units:

- Emergency Control Center (ESC) is a workplace that coordinates the activities of ERO units in implementing measures to mitigate consequences of level 2 and 3 events. It is responsible for informing the public, cooperates with the Regional and District Emergency Commission and external bodies and organizations,
- Center of Technical Support (TPS) is part of ECC and provides assistance to the operating staff of the unit control room in managing events classified as level 2 or 3,
- Center of Operating Support (PPS) is part of ECC and its activities are oriented towards staff protection, evaluation of radiation situation, development forecasts, development and implementation of measures adopted at the nuclear installation site,
- External Evaluation Center (VVS) located outside of the nuclear installation site, is responsible for radioactivity monitoring and estimation of doses in NPP surroundings, as well as for the development of first recommendations concerning protection of the population.

The information flows start as early as upon the occurrence of an event (§24 of Act No.130/1998 Coll.LL.) that is notified to ÚJD, the Slovak Energy Control Center (SED) and subsequently to the emergency service of SE, a.s.

As soon as an emergency situation has occurred, information have to be provided to the regulatory bodies (ÚJD, SHI), SE, a.s. Headquarters, Slovak Center of the Radiation Monitoring Network Center (SÚRMS) and emergency commissions at the regional level (regional and district). Information flows on the condition of the technological equipment and of critical safety-relevant functions between NPP and ERC ÚJD are organized on-line, pursuant to Act No. 130/1998 Coll.LL. and the agreement made between SE, a.s. and ÚJD.

4.7.4 Off-site emergency plans (population protecting plans)

Of site emergency plans in case of nuclear accident of a nuclear installation are developed by Regional and District Offices of jurisdiction over areas located within the region at risk, defined as an area of 30 km in diameter for SE-EBO and 20 km for SE-EMO. Villages located in the territory at risk develop of site emergency plans for the case of nuclear accident of a nuclear installation . The of site emergency plans are linked to internal emergency plan of NI operator who is liable to present to developers of site emergency plans background documents concerning the hazards expected to occur upon an incident or accident .

Of site emergency plans are being developed under coordination on the part of MV SR and are subject to review by ÚJD and other state administration authorities, and having received approval by the Head of the corresponding Regional or District Office, they are submitted to MV SR for approval.

Upon the occurrence of an extraordinary situation that is of the nature of a radiation event at nuclear installation , Regional, District and Community Offices take care of measures under of site emergency plans . For this purpose, they establish Regional or District Commissions for Radiation Accidents that have the status of an advisory, coordinating and steering body to the Head of the corresponding Regional or District Office on matters of standard provision for the development and implementation of measures to protect the population and the economy upon the occurrence of a radiation event. The activities of the said commissions run under the umbrella of KRH SR that is the steering, advisory and coordinating body of the Slovak government. To prevent risk of delays in fulfilling tasks connected with protection of the population, KKRH and OKRH and/or KRH SR are part of the national emergency response organization (hereinafter „ERO“).

Upon the occurrence of a radiation event associated with release of radioactive substances, NI operator in accordance with on-site emergency plan, Population Protection Plan and based on evaluation of the situation concerning the technology, identification of the source, values measured by the teledosimetric system, first measurements of the radiation situation in the NI environment and the meteorological situation, takes care without any delay of the warning of and communication to the population in the territory at risk. Subsequently, state administration authorities, local state administration and villages take care of further unavoidable and subsequent measures consisting mainly of nuclear prophylaxis, hiding and/or evacuation, a.o. The said measures are to be implemented in territories affected by the consequences of the radiation event, including territories to which consequences of the extraordinary event may spread as suggested by forecasts.

Suggestions for measures to protect the population come and are taken care of at all levels of the state administration management and of the sectors involved.

For consequences of a radiation event exceeding the territory of a single district, measures concerning protection of the population are coordinated by the Regional Office of jurisdiction. For radiation events whose impacts exceed the territory of a single region, the Slovak Government declares and recalls emergency situation for the territory at risk to contain the impacts of the accident.

Upon radiation events, KRH SR continuously monitors KKRH activities, makes decisions to support the implementation of the necessary measures of the of -site emergency plans , creates conditions for their implementation, reviews the activities and coordinates the activities of regional commissions. Similarly, KKRH coordinates activities of district commissions under its jurisdiction. For this purpose, KRH SR takes conclusions and recommendations by expert and supporting units (such as OSG, ERC ÚJD, SÚRMS) that as a rule closely cooperate also with KKRH and OKRH.

The responsibility for monitoring and evaluation of radiation situation in case of a radiation event is with SÚRMS.

4.7.4.1 Emergency transportation orders

For the purposes of transportation and movements of nuclear fuel, spent nuclear fuel, nuclear materials and radioactive wastes, the carrier develops, pursuant to Act No. 130/1998 Coll.LL. and ÚJD Decree No. 45/1999 Coll.LL. emergency transportation orders (HDP). The purpose of such HDP is to provide for preventive and protective measures for the case of an accident or incident during the transportation. NI operator (SE, a.s.) develops HDP for the transportation of said materials on roads and railroads under his administration. The Railways of the Slovak Republic (ŽSR) develop emergency transportation schedules for transportation in the territory of the Slovak Republic on railroads. Having been reviewed by ÚJD and other bodies involved, HDP is submitted to Ministry of Transport, Posts and Telecommunications of the Slovak Republic for approval.

4.7.5 Population and staff warning and notification systems

Population warning and communication follows Act No. 42/1994 Coll.LL. on Civil Protection of the Population, as amended. The respective competencies and roles of the corresponding bodies and organizations are precise by “Agreement on Cooperation in Providing for Emergency Preparedness“ made between Office for Civil Protection of Public Administration Section of MV SR and SE, a.s.

System of public warning and communication with bodies and organizations within a radius of 30 km around the Bohunice is secured by a system of mass remote-control through power grid elements (HDO). HADOS receivers are used for communication systems that are able to receive 7 signals. The following signals are used: 1-EBO on alert, 2- Bohunice on alert, 3- Bohunice emergency status, 4- Bohunice accident, 7-functionality check. Members of emergency commissions, mayors of villages and towns, large enterprises and other institutions within a radius of 30 km around NPP Bohunice, as well as all members of KRH SR (approx. 1500 in total) are equipped with such receivers.

Control receivers HERKUL-S (a total of 419) are used to warn the population: whenever needed, they switch on 419 rotator sirens within 30 km, whereby pectoral control . Additional information are provided by media. Besides the system HDO public warning is secured also by public communication means. For this purpose a computerized system ZU 1619 ZUZANA is used.

The responsibility for the triggering of both systems (HDO and Zuzana) is with the shift engineer . Regular testing of HADOS receivers for communication is done 4 times a year. Warning (sirens) are tested once a month .

The systems of population warning and communication with bodies and organizations within 20 km from the Mochovce is secured by :

1. the warning system including a system of electronic sirens able to work 72 hours without connection to the electricity grid and enabling group selection and transmission of radio signals and feedback that provides information about the state of all sirens;
2. the communication system made up by pagers for emergency staff, mayors of villages and towns.

Both systems are controlled from NPP Mochovce control center, and the responsibility for their triggering is with the shift engineer . The systems are regularly tested.

4.7.6 Maintenance of emergency preparedness systems

The staff at branch plants SE-EBO, SE-EMO and SE-VYZ are classified into 4 categories depending on the extent of emergency training:

- Category I – staff staying at NI over short periods of time (visitors, excursions, etc.);
- category II – staff permanently working at NI;
- category III - ERO staff ;
- category IV – mayors of villages and towns within the emergency planning zone.

The training includes two parts:

- theoretical training,
- practical training.

Emergency training of the power plant staff is organized within training sessions, according to their corresponding category. Emergency training of shift staff represent a separate part of the training. Emergency drills, so-called shift emergency drills, are organized twice a year for each shift. Once a year, whole-site emergency drill is organized under the participation of all employees of the respective branch plant.

A separate emergency drill is the large scale emergency exercise that usually is organized within the whole-site emergency drill in cooperation with KKRH, OKRH, KRH SR, ERC ÚJD and/or other ERO components (firefighter teams, medical staff, army, etc.). Such drills are organized regularly at yearly intervals, as a rule with the participation of ERC ÚJD and some KKRH or OKRH. The most recent collaborative drill under the participation of KRH SR, OSG and SÚRMS was organized in October 1997.

After the completion of drills, their course is being evaluated by observers and jury, and measures are taken to improve the activities of the individual ERO components. The implementation of such measures is subsequently verified upon and reviewed by the branch plant management.

4.7.7 International agreements

4.7.7.1 Agreements deposited at the International Atomic Energy Agency

The Slovak Republic is signatory to international agreements in the field of early informing on nuclear accidents and in the area of mutual assistance in cases of nuclear accidents, thus providing for international cooperation to minimize impacts of nuclear accidents. The agreements above all concern technical and organizational provisions for mitigating the impacts of radiation on people and the environment due to accidents at nuclear installations.

Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the Case of a Nuclear Accident or Radiation Emergency

The Slovak Republic notified succession to both Conventions on 10 February 1993, effective as of 1 January 1993. The responsibility with respect to the Convention provisions is with ÚJD that at the same time is the contact site for the Slovak Republic for early notification of nuclear accidents. Through ÚJD, the Slovak Republic has been regularly participating in international exercises. Since the effective dates of the Conventions, there has been no accident in the Slovak Republic according to the terms of the Convention provisions.

4.7.7.2 Agreements and cooperation with neighboring countries

Further to art.9 of Convention on early notification of nuclear accidents, the Slovak Republic succeeded to, and/or signed bilateral agreements in the field of early notification of nuclear accidents, exchange of information and cooperation. The agreements set the form, method and extent of information to be provided to the contracting parties in case of an accident connected with a nuclear installation or nuclear activities, and also appoint coordinators of contact points. The purpose of the said agreements is to make a contribution to minimalise of risk and consequences of nuclear accidents and to create a framework for bilateral cooperation and exchange of information in areas of common interest in connection with peaceful uses of nuclear energy and protection against radiation.

Agreement between the Government of the Czechoslovak Socialist Republic and the Government of the Republic of Austria on Issues of Common Interest in Connection with Nuclear Safety and Radiation Protection (Vienna, 25 October 1989).

Under the Agreement, regular annual meetings of representatives of governmental organizations of the Slovak Republic and Austria take place concerning issues of common interest in the field of peaceful uses of nuclear energy. Representatives of governmental organizations of the Slovak Republic and Austria exchange information and experiences, above all from the field of emergency preparedness, at special meetings of experts; important is the participation of Austrian experts as observers in emergency exercises in the Slovak Republic.

Agreement between the Government of the Czech and Slovak Federal Republic and the Government of Hungary on Exchange of Information and Cooperation in the Field of Nuclear Safety and Radiation Protection (Vienna, 20 September 1990)

Based on the Agreement, regular annual meetings of representatives of the Slovak Republic and Hungary are organized aimed at exchanging information and experiences in the field of safe uses of nuclear energy and radiation technologies. Cooperation has developed at the same time in the field of emergency planning, with representatives of both contracting parties taking part in emergency exercises.

Agreement between the Government of the Slovak Republic and the Government of the Czech Republic on Cooperation in the Field of State Supervision of Nuclear Safety of Nuclear Installations and State Supervision of Nuclear Materials (Bratislava, 8 March 1996).

Based on the above Agreement, regular meetings of experts are organized, above all concerning exchange of experience with the exercise of regulatory activities, aimed at securing the highest standard possible of nuclear installations and safety of treatment of nuclear materials, and intensive cooperation is also going on in the field of emergency planning in setting up emergency centers of regulators.

Agreement between the Government of the Slovak Republic and the Government of Poland on Early Notification of Nuclear Accident, on Exchange of Information and Cooperation in the Field of Nuclear Safety and Radiation Protection (Bratislava,17 September 1996).

Under the Agreement, annual meetings of representatives of governmental organizations of the Slovak Republic and Poland are organized aimed at exchanging information and experiences in the field of safe uses of nuclear energy and radiation technologies.

Agreement between the Government of the Slovak Republic and the Cabinet of Ministers of Ukraine on Early Notification of Nuclear Accidents, on Exchange of Information and Cooperation in the Field of Nuclear Safety and Radiation Protection .

The Agreement was signed in 1999, and its aim was not only laying down the format and method of providing information in cases of a nuclear accident, exchange of information and experience in the field of uses of nuclear energy for peaceful purposes, but also strengthening of mutual trust and information in a sensitive issue such as safety of the nuclear power sector.

In addition to agreements with neighbouring countries, the Slovak Republic has concluded following agreements on cooperation in the field of peaceful uses of nuclear energy:

Agreement between the Government of the Czech and Slovak Federal Republic and the Government of the Federal Republic Germany on the Regulation of Issues of Common Interest concerning Nuclear Safety and Radiation Protection (Prague, 30 May 1990)

Although the geopolitical situation changed after the split of the ČSFR, the Agreement has remained in force and the Slovak Republic fulfills its commitments under the Agreement concerning early notification of nuclear accidents and exchange of information.

Agreement between the Government of the Czech and Slovak Federal Republic and the Government of the United States of America on Cooperation in Peaceful Uses of Nuclear Energy (Vienna,13 June 1991).

The Agreement mainly focuses on exchange of information and experiences in the field of nuclear installations safety; this is being provided for through meetings, training of experts and exchange of computer seawares.

Agreement between the Slovak Nuclear Regulatory Authority and United States Nuclear Regulatory Commission of the United States of America on Exchange of Technical Information and Cooperation in Nuclear Safety (Washington, 10 November 1995)

The Agreement focuses on exchange of technical information and cooperation in the field of nuclear safety that run through meetings and training of experts and exchange of computer software.

4.7.7.3 Slovakia's participation in international exercises

Pursuant to Act No. 130/1998 Coll.LL. and ÚJD Decree No. 245/1999 Coll.LL., NI operators and bodies responsible for off-site emergency plans are responsible for regular exercise activities included in emergency plans. In connection with international agreements and also bilateral agreements, Slovakia participates, through ÚJD, in also international exercises in the field of emergency preparedness, aimed at harmonizing emergency preparedness and planning with other countries of the European region. Within 1995 – 2000, the Slovak Republic, represented by ÚJD, participated in 4 INEX 2 exercises organized by OECD/NEA. The major objectives of these exercises included real-time communication, evaluation of the condition of nuclear installation and radiological situation, and informing of the public in case of a nuclear or radiation accident. ÚJD moreover participated in the exercise HEXAGRANT under the responsibility of the Army of the Slovak Republic. This exercise attended by 5 countries neighboring with the Slovak Republic, concerned unification of approaches toward taking of protective measures and coordination of command and activities at international level. Also, ÚJD participated in the exercise VIRIBUS UNITIS organized by Austria. In this case, harmonization of the activities of civil protection components of the individual countries participating in the exercise was trained. In 2000, ÚJD was involved in an international exercise organized by IAEA in cooperation with the World Meteorological Organization – WMO; the aim was to unify the interpretation of meteorological data. The most recent joint exercise took place in 2001, with the Slovak Republic having taken part in the first exercise of the new series of exercises INEX 2000, and an exercise under the participation of Austria and Hungary.

4.8 Public relations

Act No. 130/1998 Coll.LL. and Act No. 211/200 Coll.LL. (Freedom of Information Act) represent the legal framework for public relations. Operators of nuclear installations are responsible, pursuant to Act No. 130/1998 Coll.LL. (§24(4)) to notify ÚJD on events at the facilities operated and, in case of an incident or accident, have also to inform the public and the media. According the latest act the operator is in addition responsible to provide information to the public on nuclear safety, which is not a classified information.

In their information centers and in the form of excursions, operators of nuclear power plants at Mochovce and Bohunice provide interested parties of various age categories, in particular from schools, throughout the year with information and data on the nuclear facilities operated, on ionizing radiation, climatic changes, sustainable development, etc. Premises of NPP Bohunice and NPP Mochovce are visited by 10 to 12 thousands visitors from whole Slovakia and from abroad yearly. Safety improvement at NPP Bohunice V-1 and V-2 units and start up of NPP Mochovce units markedly influenced the life in the regions, thus at the same time contributing towards an appropriate bilateral communication with the vicinity . Apart from the monthly „Spravodajstvo SE, a.s." (ES, a.s.´s News), also regional monthlies „Bohunice" and „Mochovce" assist a forthcoming and transparent communication; they are distributed free of charge in the area, and offer continuous , open and transparent information to the public on recent developments in the nuclear power plant and nuclear power system in general. In addition to spreading information in the regions, NPP also make a general contribution towards the infrastructure of the regions, with the main priorities including support to the health sector, sector of education, social institutions, culture and sports. Also important is the transfer of information between NPP and special-interested regional associations at villages Jaslovské Bohunice and Vráble.

ÚJD provides information in the area of its competencies, in particular concerning operational safety of nuclear power generating installations, independently of NI operators, and enables the public and the media to verify the data and information on nuclear installations. An important element of the informing is the demonstration that uses of nuclear energy in Slovakia follow binding rules, and their fulfillment is controlled by state through an independent authority.

Every year, ÚJD sends to press agencies , dailies and electronic media 70 – 80 articles concerning its domestic and international activities. ÚJD, along with State Authority for Nuclear Safety of the Czech Republic (SÚJB) publish the professional periodical „Safety of the Nuclear Power Sector" with articles of principal importance on important activities of both nuclear authorities appearing there. Domestic and international activities of ÚJD are also published in „Bulletin of the Slovak Nuclear Society (SNUS)" and in ÚJD Bulletins. ÚJD regularly contributes to the world information agency NucNet and publishes, every year, an annual report that contain results of ÚJD activities and data on the safety of nuclear installations . The Annual Report is published in Slovak and English languages. ÚJD´s information center develops special-topics materials, video-clips, they organize press conferences, and consultations. Special attention was paid in 2001 to the implementation of Act No. 211/2000 Coll.LL. on provision of information and materials requested by the public.

5. Safety of nuclear installations of in Slovakia

5.1 Site selection

5.1.1 Legislation relating to site selection

See National Report as of September 1998.

5.1.2 Meeting of criteria at the Bohunice and Mochovce sites

See National Report as of September 1998.

5.1.3 International agreements

In connection with the planning and constructing of NI the neighboring countries have to be informed on any nuclear installations planned and on the assumed commissioning dates of the nuclear installations under construction.

Concerning multilateral agreements, the Slovak Republic is signatory to the following agreements:

- Convention on transboundary environmental impact assessment,
- Basel Convention on the Control of Transboundary movements of hazardous wastes and their Disposal.

5.2 Design preparation and construction

5.2.1 Legislation relating to design and construction

See National Report as of September 1998.

5.2.2 Project preparation for the Bohunice and Mochovce nuclear installations

See National Report as of September 1998.

5.3 Operation

5.3.1 Licensing procedure

See National Report as of September 1998.

5.3.2 Operation limits and conditions

It was already the former ČSKAE that required limits and conditions for operation (L&C) as part of the safety report. L&C are in place for all nuclear installations in the Slovak Republic, whose format and content follow IAEA and US NRC guidelines. Every limiting condition containes:

- Objective,
- Wording,
- Validity (to what mode of the nuclear installation it applies),
- Activities of the operating staff upon the limit conditions being not met,
- Requirements on control – set the frequency, type and extent of controls and tests of systems and equipment.

L&C were issued for NPP Bohunice V-1 units prior to their commissioning in 1978, they had been reviewed by a variety of research institutions, including VÚJE. L&C for WWER-440/230 units were issued in mid-1980s, revised according to the IAEA guide (SG – O3) with using the format of Westinghouse and US NRC guidelines for PWR units. Having been approved by the regulator, they came into force in 1988.

L&C for NPP Bohunice V-1 unit operation were amended in 1995 to make three separate documents (their content and form following IAEA and US NRC guides):

- Limits and conditions for the operation of NPP Bohunice V-1 unit 1,
- Limits and conditions for the operation of NPP Bohunice V-1 unit 2,
- Limits and conditions for the operation of the interim spent fuel storage facility

L&C was amended in January 2001 that became part of the Safety Report After Gradual Upgrading. The documents were submitted to ÚJD for review.

L&C for NPP Bohunice V-2 units were developed according to IAEA guide (50 – SG – O3) and US NRC guide (for PWR units) as soon as the nuclear installation was commissioned. In March 1998, amended L&C were issued, being split into two separate documents:

- Limits and conditions for the operation of NPP V-2 unit 3,
- Limits and conditions for the operation of NPP V-2 unit 4.

The amended L&C were reviewed by the regulator and approved according to the regulations during 1998 and 1999.

Limits and conditions of safe operation of NPP Mochovce were developed and reviewed within the Pre-operation Safety Report. ÚJD approved the draft L&C in April 1998. L&C follow IAEA and US NRC guidelines. Their formal structure is the same as L&C for the operation of NPP Bohunice units, with limit conditions added, based on specific design of NPP Mochovce. The document was amended in 1999 and 2000, being split into two separate documents:

- Limits and conditions of safe operation of NPP Mochovce unit 1,
- Limits and conditions of safe operation of NPP Mochovce unit 2

Limits and conditions of the operation of the interim spent fuel storage facility (ISFSF) were developed in accordance with the Safety Report. Since the early days of the deposition of spent fuel until 1995, L&C used to be organizational part of L&C for the operation of NPP V-1 units. In January 1998, L&C were amended by the operator, they were reviewed by ÚJD and approved in July 1998 for the period of the ISFSF upgrading until January 2000. Following the completed upgrading, new L&C were developed as

part of the Safety Report After the Upgrading. L&C were developed in accordance with IAEA and US NRC guidelines, reviewed by ÚJD and approved in January 2000.

Limits and conditions for the operation of the National Repository of RAW (RÚ RAW) were developed as part of the Safety Report. Formally, their structure follows IAEA and US NRC guidelines. They were reviewed by ÚJD and approved in July 1999.

Limits and conditions for the operation of the Bohunice RAW Processing Center were developed as part of the Safety Report, based on IAEA and US NRC guidelines. L&C are linked to limits and conditions for the operation of RÚ RAW. Formally, they have been drafted in accordance with L&C for all other the other nuclear installations in the Slovak Republic. L&C were reviewed by ÚJD and approved in July 2000.

The adherence to limits and conditions is continuously monitored by the operating staff and, on a daily basis, by the staff of technical support.

Prior to setting the unit on a lower sequential number mode, the operating staff have to verify such transition based on checklists that are part of operating documents. The verification verifies whether all limits and conditions applicable to the transition mode are met. Shift engineer does not approve such a transition unless the meeting of all L&C has been verified .

The responsibilities of individual employees and/or divisions of operator to notify regulatory bodies of the occurrence of a „L&C Violated“ situation is laid down in also the quality assurance directive „Management of Events at Nuclear Installations“ that basically contains three levels of notification:

- The regulatory body must be notified by phone within 8 hours; responsible is the shift engineer on duty;
- operator has to send the regulatory body, within 72 hours, a preliminary report on the event;
- within 30 days, operator has to present a report on L&C violation, along with an analysis reviewed by the Failure Commission.

If there is a need to amend L&C, an annex to the regulation is drafted with the corresponding reasoning, and such a change becomes effective upon being approved by the regulatory body.

Operator’s nuclear safety supervision departments draft periodical quarterly and annual reports on the status of nuclear safety; the reports are presented to the power plant management. As part of the reports, also the whole area of L&C is evaluated. The parameters include numbers of changes made in L&C, allowed draw dawn of the time during which limit conditions have not been met, duration of safety systems being not available, and L&C violation, if any.

5.3.3 Maintenance testing and control documentation for management and operation

See National Report as of September 1998.

5.3.3.1 Operating documentation

For the overall description of operating documentation, see National Report as of September 1998.

Symptoms-based emergency operating procedures were developed for NPP V-2 and NPP Mochovce in cooperation with Westinghouse Electric Europe, Brussels. The unit control room staff was trained and the procedures were put in place in 1999.

Presently, similar procedures are being drafted for NPP V-1 in cooperation with the same contractor.

5.3.3.2 Documentation for equipment inspections and testing

See National Report as of September 1998.

5.3.3.3 Technological and working maintenance procedures

See National Report as of September 1998.

5.3.4 Technical support of operation

See National Report as of September 1998.

5.3.5 Analysis of events at nuclear installations

ÚJD Regulation No. 31/2000 Coll.LL. on events at nuclear installations (NIE) came into force in 2000. The Decree lays down detailed regulations concerning the classification of the individual types of events (failures, incidents, accidents), based on Act No. 130/98 Coll.LL. It also sets the method of notification of events, method of identification of event causes, and sets the method of informing the public.

Pursuant to Regulation No. 31/2000 Coll.LL., the operator adjusted the whole process of notifications and management of events (see National Report as of September 1998.) as well as internal regulations to provide for feedback from NIE.

5.3.5.1 Definition and classification of events at nuclear installations

Pursuant to Act No. 130/1998 Coll.LL., an event at nuclear installation means an event which is associated with the threat or violation of nuclear safety of nuclear installation during the commissioning, operation or decommissioning of the latter. The Act recognizes three categories of NIE according to their severity:

1. **Failures** are events that caused a discrepancy with requirements on nuclear safety of nuclear installation or were identified upon the operation, maintenance or inspection of the nuclear installation, and might result in an incident or accident.
2. **Incidents** are events that caused damage of low importance to nuclear installation or damage to the health of the employees; they however caused the nuclear installation to be automatically shut down, or forced a shutdown of the nuclear installation for the purposes of repair, because of violation of limits and conditions, release of radioactive substances within the premises and on the site of the nuclear installation or contamination or irradiation of employees.

3. **Accidents** are events associated with severe damage to the nuclear installation or followed by a severe damage or potential severe damage to health due to ionizing radiation or release of radioactive substances into the environment.

Generally, operator classifies **operating events** (OE) as follows:

1. events subject to notification to regulatory and supervisory bodies – they are most important from the viewpoint of nuclear safety and reliability; they include the above mentioned NIE classified pursuant to Act No. 130/1998 Coll.LL.,
2. events subject to internal notification within the individual single branch plants (so-called recorded); they include events of lower safety relevancy. Operator investigates the reasons of such events so as to prevent them from repeating.
3. events with no consequences or so-called near miss events – they include incorrect activity resulting in no actual untoward consequences that, under different circumstances, may have resulted in untoward consequences.

Criteria for the classification of NIE are defined in internal QA documents.

5.3.5.2 Documenting and analysis of events at nuclear installations

The schedule of the procedures for investigating NIE, including the method of notification of the regulatory body is shown in the corresponding QA (flow diagram) for event notification and analysis. The Shift Engineer (ZI) completes a notification slip on the event, using the prescribed form, and attaches to it statements by the corresponding staff.

NIE analysis is the responsibility of SSV that conducts it based on positions by expert units and own analyses and/or results provided by working groups.

For NIE meeting the criteria of investigation of the root cause, SSV (Feedback Group) in cooperation with the corresponding divisions, conducts a comprehensive analysis using one of the following methods and/or their combination:

- HPES - "Human Performance Improvement" developed by INPO, USA. This method includes analysis of tasks, barriers and changes, and offers a general view of NIE.
- ASSET-" Assessment of Safety Relevant Events“ developed by IAEA.

Analysis of NIE subject to external notification is completed by drafting of a Report on Operating Event to be presented to the Failure Commission for review. The commission is a collective advisory body to power plant directors on NIE management. Failure Commissions usually meet on a monthly basis and approve conclusions of analyses, and impose targeted remedial measures that become binding upon all employees. NIE reports are presented to regulatory bodies, whose representatives are entitled to attend Failure Commission meetings.

So-called recorded events are subject of a similar analysis, but no separate report is drafted on them. Slip notification is presented to the Failure Commission on the event and on remedial measures.

The implementation of remedial measures is documented by the corresponding division in charge via computer network, where it stays archived. The status of the implementation is verified by the Failure Commission.

The whole NIE investigation and analyses agenda is kept in a computer network where all network users have access to. Every network user may make a statement on operating events, comment on them or inform on serious findings. Editing interventions may only be done by SSV members who deal with the investigations of the reasons for events at nuclear installation.

Extraordinary Failure Commission

Extraordinary Failure Commission (MPK) is convoked by Deputy Plant Manager for operations (and/or head of the Failure Commission on duty) immediately after having obtained information from ZI on an accident or incident having occurred, provided that such events are not subject to management according to internal emergency plan by Emergency Commission. MPK is also convoked upon the occurrence of other NIE that meet the criteria for it being convoked. The task of MPK is to identify the direct cause of the event, and to define immediate remedial measures.

Protocols of MPK meetings are presented to ÚJD and SE, a.s.´s headquarters. They are included in interim reports on operating event. The final analysis, including the analysis of the root cause, is drafted by SSV as a standard report on operating event, and the report is then presented, together with remedial measures, to regular Failure Commission for approval. Completed „Surveillance Program“ is presented to MPK, serving post-accident inspection.

Independent NIE assessments

Operating event reports are presented to also VÚJE that periodically (at yearly intervals) makes independent assessments of events and suggests remedial measures. The report is also made available to operator.

Reporting of events

Pursuant to ÚJD Decree No. 31/2000 Coll.LL., operator is responsible to inform in a given time frame state authorities on NIE. The first information on incidents or accidents must be provided to ÚJD by operator by phone, facsimile or in person without any delay, within 30 minutes of the event having been identified. Interim reports must be presented to ÚJD by operator in writing within 72 hours of the identification of an incident or accident, and final report must be presented within 30 days of identification. Data required are defined by the Decree and have been reflected in internal QA document. As part of the documentation, also interim NIE assessment according to INES scale must be recorded.

Operator presents to ÚJD a summary written report on failures by the 20th day of the subsequent calendar month.

Upon identifying shortcomings in notification and/or NIE analysis, ÚJZ requests their elimination and/or performs an independent investigation of the event, and issues binding measures.

Provision for feedback from events at nuclear equipment of other NPPs

Operator uses international information systems on operating experiences from nuclear power sector (WANO and IAEA) to apply measures based on analyses of failures by foreign operators to his own units,

and also presents his own experiences to foreign operators. The purpose of such an activity is to prevent similar failures from repeating, through implementation of preventive measures as well as to prevent redundant safety analyses and non-standard approach towards the solution of problems. QA document „Feedback from NIE at Other NPPs“ regulates the detailed procedure of processing and using information on NIE that occurred at other NPPs.

Evaluation of the efficiency of remedial measures implemented

The main indicator of the efficiency of the feedback from own NIE is the trend of failures with an analogical mechanism of failure. SSV develops at yearly basis summary statistical evaluation of the occurrences of repeated events, and assesses them with respect to the efficiency of measures implemented.

Efficiency of remedial measures depends on the type of the measure, and is provided for under the quality assurance system:

- remedial measures implemented as design changes are evaluated according to the directive „Documentation of Equipment Changes",
- changes in operating instructions, testing programs, “Surveillance Programs” and organizational adjustments concerning the keeping of operating documentation are evaluated after their application to unit operation if allowed by the nature of the change. They are evaluated in a standard manner under amendments to operating procedures on a 3-year cycle basis,
- for measures resulting in changes of procedures for abnormal and emergency operation whose correctness cannot be verified during real unit operation, the system of effectiveness control of changes is connected with the mechanism of validation of such regulations.

Information flows on NIE within SE,a.s.

Heads of the corresponding departments and divisions are responsible for :

- continuously make themselves familiar with NIE database,
- continuously make them familiar with reports on events and with protocols from meetings of regular and Extraordinary Failure Commissions every month,
- include applicable knowledge to training programs for employees reporting to them. In cooperation with the department of human resources training and with employees of the VÚJE training center, they take care of the incorporation of knowledge derived from NIE into programs of initial and repeated training (re-training).

It is the obligation of every employee to know the results of NIE analyses, in particular of those he/she was involved in. If the inputs or results of analysis contradict their observations or understanding of the event, they are entitled to request the Head of the SSV department to complete the solution to NIE or to provide an explanation for the discrepancy.

Near miss events

Aiming at preventing severe events as well as a measure to improve the safety culture, operator introduced in 2000 a system of notification and feedback from minute events, so-called near miss. Employees are encouraged on the part of the branch plant management to notify small events. Any employee may notify such events, either in writing, by phone or in person to his/her direct supervisor, or

electronically to SSV. Forms for notification of near miss events are available at every working place of operating staff. Notifications on near miss events are recorded and evaluated by SSV. Criteria for notification were defined in six areas: documentation, man-machine interface, working environment, working practices, organization of labor, and staff training. SSV makes suggestions for remedial measures that are presented to Failure Commission.

5.3.5.3 Statistical evaluation of events at nuclear installation, developmental trends

This section presents data on events that occurred at nuclear installations in the Slovak Republic in 2000, and developmental trends for the recent period of time.

Overall, the numbers of events at NPP **Bohunice** has stabilized in recent years. No event has been recorded that would have severely impacted upon nuclear safety. At no nuclear installation there was an event exceeding level of a failure.

Fig. 5.3.1 Development of the overall numbers of events a

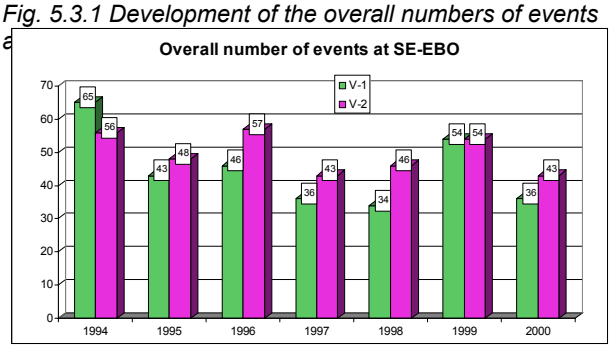


Fig. 5.3.2 Development of numbers of events, by INES – NPP V-1

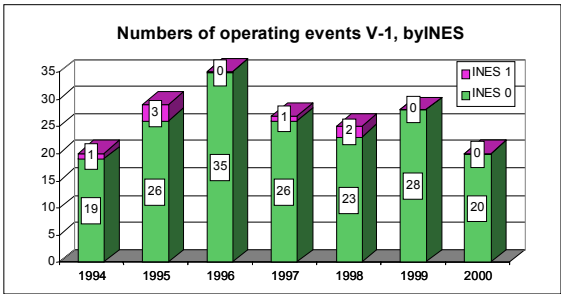


Fig. 5.3.3 Development of numbers of events, by INES - NPP V-2

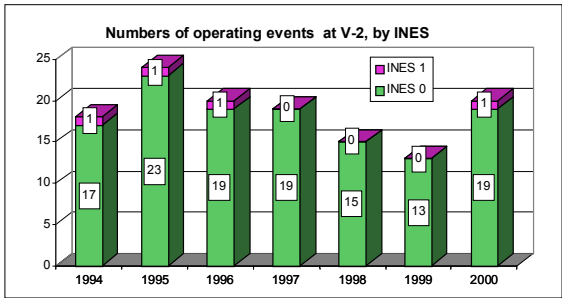


Fig. 5.3.4 Development of overall numbers of events at NPP Mochovce

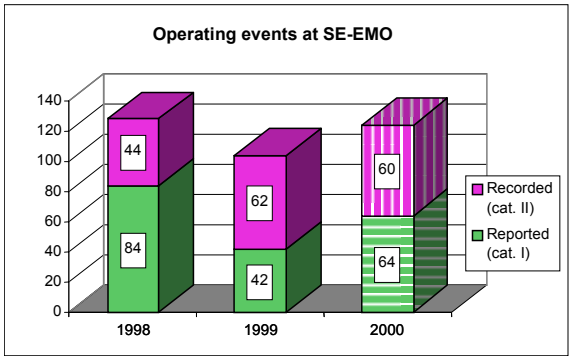
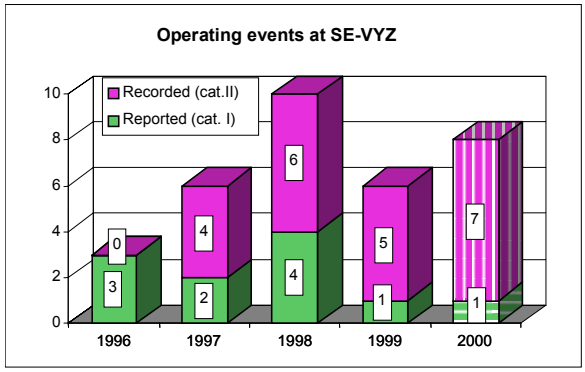


Fig. 5.3.5 Development of overall numbers of events at SE-VYZ



Note:

Prior to 1999, operating events were classified into two categories, thereby only events of category I being safety relevant. Since 2000, the events have already been classified according to the above mentioned system.

The increase in numbers of events at NPP Mochovce in 2000 was due to the commissioning of unit 2. The numbers of events at SE-EMO unit 2 in the said year were markedly smaller than those at unit 1 in 1998, i.e. the year of trial operation (128 events in 1998 at unit 1, 69 events in 2000 at unit 2). This fact is also connected with the power plant staff having acquired more operating experiences and using them. As compared to the preceding year, there was an approx. 50% reduction in numbers of operating events at unit 1 in 2000.

Table 5.3.1. shows a summary of the numbers of operating events of all NI by their INES grades. There were two INES 1 operating events in 2000, one at Bohunice unit 4 and Mochovce unit 1 each.

Table 5.3.1

Year	out of scale	INES=0	INES 1	INES>1	Total
1996	54	57	1	0	112
1997	53	54	1	0	108
1998	138	76	4	0	218
1999	162	56	0	0	218
2000	132	65	2	0	199

The most frequent causes of OE at all NI are failures of equipment, with the highest contribution by control and instrumentation equipment and electro. Ranking second are staff errors. Figures 5.3.6. through 5.3.8 show the shares of the individual causes for events in 2000 at the individual NI.

Fig. 5.3.6 Causes of OE at NPP V-1 units in 2000

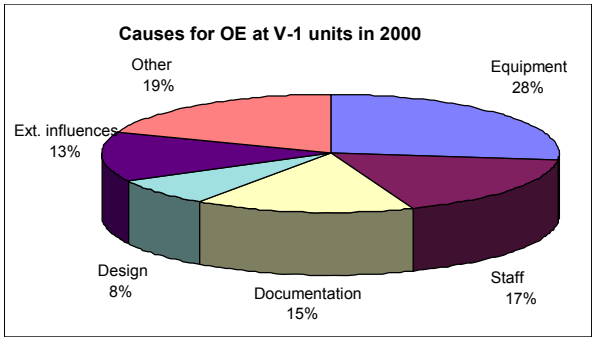


Fig. 5.3.7 Causes of OE at V-2 units in 2000

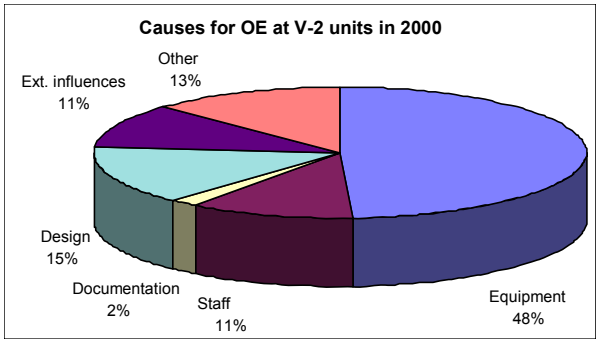
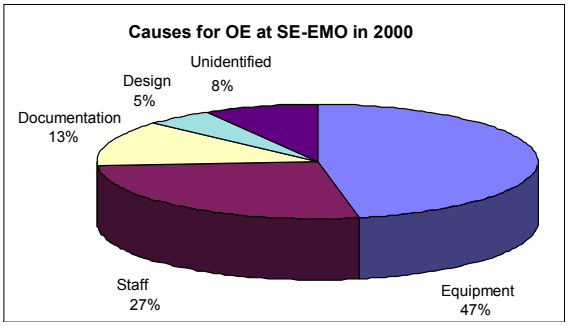


Fig. 5.3.8 Causes of OE at SE-EMO units in 2000



5.3.6 RAW generation

Amounts of solid and liquid radioactive waste generated are monitored aiming at a reduction of their generation. Reduction of the volumes of waste will also reduce the demands on their storage, transportation, and disposal, as well as their environmental impacts.

Figs.5.3.9 and 5.3.10 show amounts of RAW generated at SE-EBO.

Since so far, solid RAW generated at SE, a.s. NI are not processed to final form or transported outside the NI site, the statistics includes all solid RAW that were generated at the corresponding NI for the period of reference. For liquid RAW, their total volume in m^3 generated during the operation of the power plant for the said period of time, converted to thickened quantities at 120 g/l.

As seen from the diagrams, the generation of both solid and liquid wastes from NPP Bohunice V-1is stabilized during 1999 and 2000. The generation of solid RAW at NPP V-1 was significantly influenced by the ongoing works on gradual upgrading. There was a reduction in the generation of solid and liquid RAO at NPP Bohunice V-2 during 1999 and 2000, reflecting the systematic approach to work with RAW as described in the QA directive „Minimaizing of RAW Generation“.

Fig. 5.3.9 Solid RAW generation at Bohunice

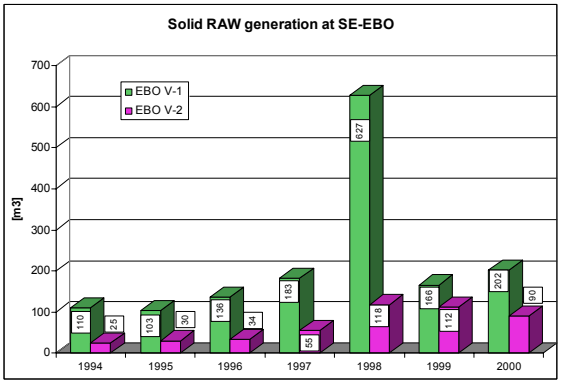
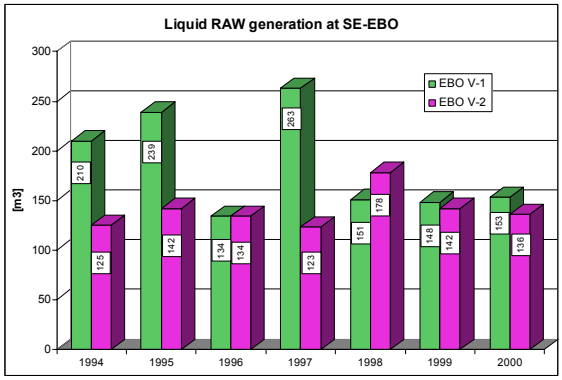


Fig. 5.3.10 Liquid RAW generation at Bohunice



At **Mochovce,** solid waste is stored in steel dwarf palettes. The total capacity is 640 palettes, as of 31 December, 2000, 190 palettes were filled with wastes, representing 28 % of the storage capacity.

Table 5.3.2

SE-EMO	1998	1999	2000	Total
Solid RAW generated (kg)	4180	3975	3606	11 761

The total storage capacity of 4 tanks of active concentrate is 2200 m^3. A total of 279 m^3 active concentrate were generated last year. During the three years of operation, one tank (550 m^3) has been filled and the second tank contains 343 m^3 concentrate.

Table 5.3.3

SE-EMO	1998	1999	2000	Total
Liquid RAW generated (m^3)	278	337	279	894

5.4 Planned safety improvement activities at nuclear installations

With the implementation of NPP Bohunice V-1 and NPP Mochovce safety improvement programs implemented, the most important long-term program is currently the „NPP Bohunice V-2 Units Upgrading and Safety Improvement Program“ (hereinafter „Upgrading Program“).

The objectives of the NPP Bohunice V-2 Upgrading Program include:

1. achievement of the required unit operation safety through reaching the probability targets according to IAEA recommendations (INSAG 3) for the NPP in operation,

2. extension of the NPP Bohunice V-2 units lifetime to a minimum of 40 years, in accordance with the development plan of SE, a.s.´s production and technological base,

3. increase unit output (from reserves and through improved efficiency of the units).

Improvements of the nuclear safety and operating reliability standards is a continuous and long-term process, and some works on the NPP Bohunice V-2 units upgrading have already been implemented during the preceding years.

The project „NPP V-2 Nuclear Safety and Seismic Resistance Improvement“ was started in 1994. Above all, the project deals with the tasks laid down in the following documents:

- IAEA suggestions and recommendations for V-213 reactor safety improvement (according to the document EBP WWER-03),
- tasks laid down in ÚJD decisions, in particular Resolution No. 4/96.

The drafting of the Safety Concept (BK) was started in 1998; as soon as approved at NPP Bohunice and by the regulatory bodies, it will become the key background document for the drafting of project and safety documentation of the „NPP V-2 Upgrading Program“. Part 1 of the Safety Concept has been drafted, with its outputs being specification and summarizing of issues:

- safety (typical of WWER-440/V-213 units),
- operation,
- connected with the lifetime extension improvement of unit efficiency and output),
- relating to upgrading tasks according to their relationship to operating systems, and suggestions for their solution (with the assessment of the opportunity of using solutions that already have been implemented at NPP Mochovce and at NPP V-1).

The document „Account of Meeting Recommendations to „NPP WWER 440, Model 213 Safety Issues“ of the IAEA Document EBP-WWER-03 and their actual status for NPP Bohunice V-2 units, has been drafted and presented to ÚJD, comprising:

- principles and recommendations for designing of systems within the program,
- assessment of design changes under development,
- solutions to individual issues at the level of the inception safety report, technical terms of reference for design,
- safety review of variant solutions,
- setting of priorities for gradual implementation of the upgrading-connected tasks.

The ”Account on Meeting of Recommendations to NPP WWER 440, Model 213 Safety Issues“ from IAEA Document EBP-WWER-03 and their actual status for NPP Bohunice V-2 units“ also includes new ÚJD requirements deriving from Resolution No. 214/2000 in which ÚJD imposes to develop terms of reference – project for individual safety measures, to implement safety category III measures by 2004, category II safety measures by 2006, and other measures from the Safety Concept by 2008. By presenting the said document to SE, a.s. the principal requirements of Resolution No. 214/2000 have been met.

6. Annexes

6.1 List of nuclear installations and technical and economic parameters

6.1.1 LIST OF NUCLEAR INSTALLATIONS

In terms of the Convention, the Joint Stock Company Slovenské elektrárne is operator of the following nuclear installations being branch plants:

- Nuclear Power Plants Bohunice, branch plant - units V-1
- Nuclear Power Plants Bohunice, branch plant . - units V-2
- Nuclear Power Plants Mochovce, branch plant – units 1 and 2
- NPGI Decommissioning and Treatment of RAW and Spent Nuclear Fuel, branch plant:
  - Interim Spent Fuel Storage Facility (ISFSF)
  - Technologies for RAW Processing and Treatment
  - National RAW Repository

Nuclear Power Plant Research Institute, Trnava a.s. (VÚJE) operates an incinerator of radioactive waste at the Jaslovské Bohunice site.

6.1.2 TECHNICAL AND ECONOMIC PARAMETERS

This section presents some technical and economic parameters of NPP Bohunice and NPP Mochovce in operation.

UNIT CAPABILITY FACTOR

Unit Capability Factor - UCF is a WANO parameter that expresses the percentage ratio of electricity actually generated on unit and energy the unit would be able to generate within the given time interval, accounting for external limiting influences (power regulation by control center, etc.). The lower coefficient values for unit 1 and 2 were due to extended overhauls to implement safety improvements – in 1996 through 2000 (see diagram 6.1.2.a.) and table 6.1.2.b.). Note: Unit 1 at Mochovce was on trial operation in 1998 and was actually only operated during approximately a single quarter.

LOAD FACTOR - COEFFICIENT OF UTILISATION

The load factor accounts for the actual supplies of electricity in relation with electricity supplies to the grid that are possible, with not accounting for external limiting factors (power regulation by control center etc.). The lower values of the load factor of the Bohunice units achieved were significantly influenced by control center requirements on power regulation and extended overhauls under the Gradual upgrading of NPP V-1 units (see diagram 6.1.2.c.) and table 6.1.2.d.).

Fig.:6.1.2a.)

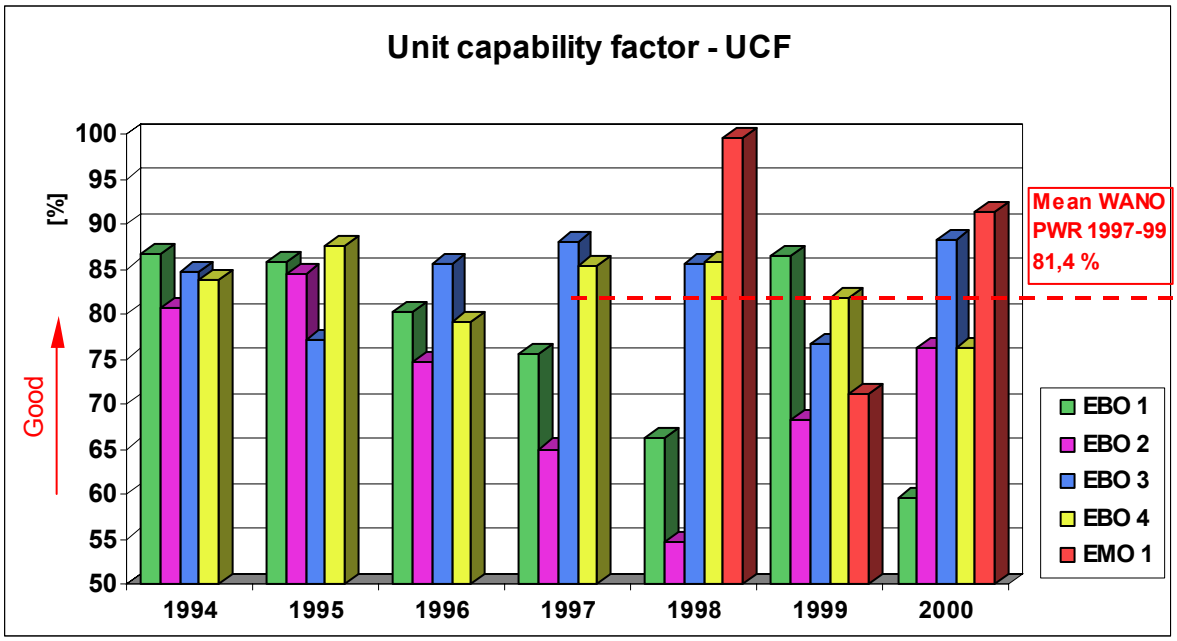


Table 6.1.2.b.)

	1994	1995	1996	1997	1998	1999	2000
NPP V-1 U1	86.59	85.82	80.23	75.50	66.13	86.38	59.53
NPP V-1 U2	80.70	84.46	74.60	65.0	54.59	68.27	76.31
NPP V-2 U3	84.67	77.07	85.52	88.0	85.46	76.67	88.13
NPP V-2 U4	83.85	87.52	79.15	85.3	85.79	81.67	76.32
NPP Mochovce U1					99.6	71.03	89.55

Fig.:6.1.2.c.)

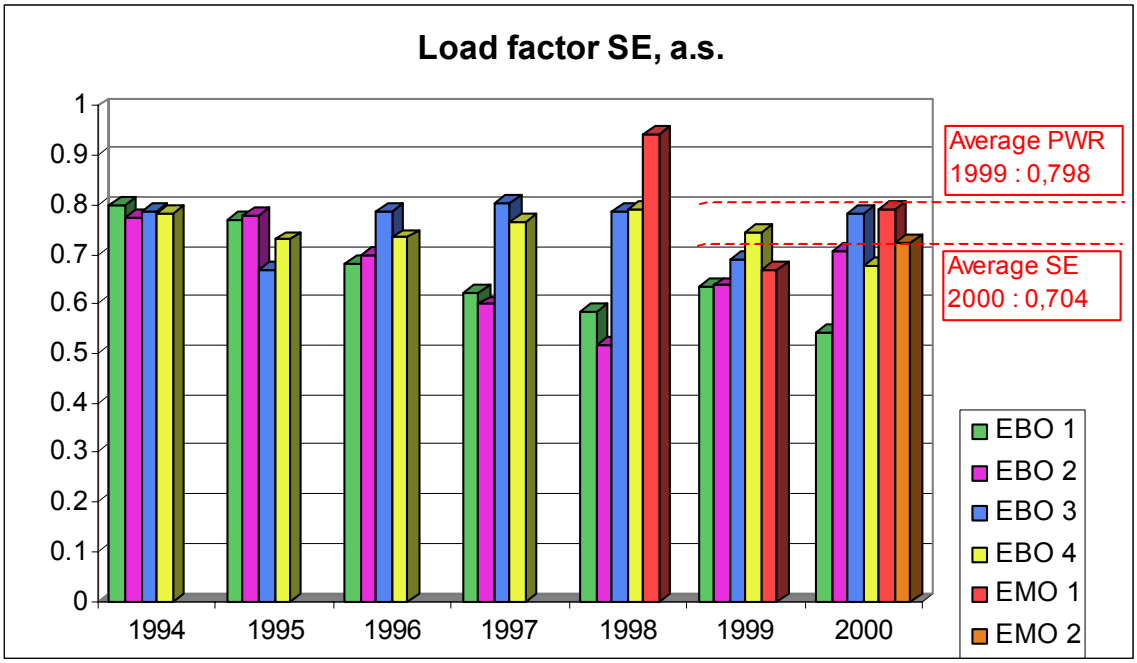


Table: 6.1.2.d.)

	1994	1995	1996	1997	1998	1999	2000
NPP V-1 U1	0.798	0.770	0.682	0.623	0.584	0.635	0.544
NPP V-1 U2	0.773	0.780	0.699	0.599	0.515	0.637	0.705
NPP V- 2 U3	0.785	0.668	0.787	0.802	0.785	0.691	0.783
NPP V- 2 U4	0.781	0.730	0.734	0.765	0.790	0.743	0.679
NPP Mochovce U1					0.944	0.670	0.792
NPP Mochovce U2							0.723

ELECTRICITY GENERATION

NPP Bohunice units generated in 2000 a total of **10 546 884 MWh,** representing a slight increase compared to 1999 (10 513 827 MWh). NPP Mochovce generated a total of **5 946 691 MWh** electric energy (see diagrams 6.1.2.e.) and 6.1.2.f.).

Fig.: 6.1.2.e.)

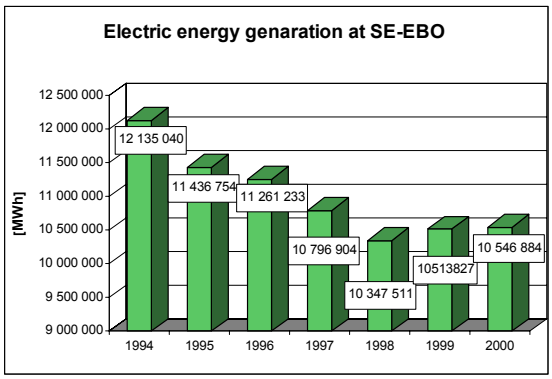
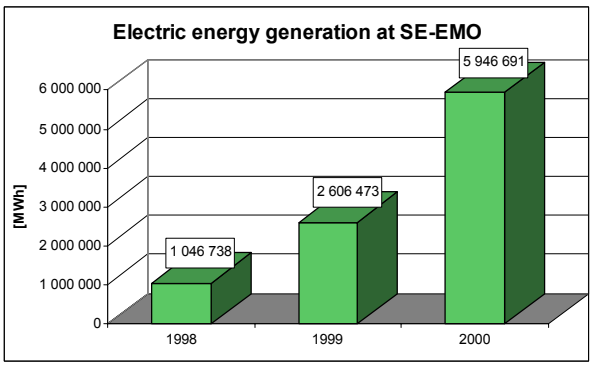


Fig.:6.1.2.f.)



NI of SE-VYZ PARAMETERS FOR 2000

No.	Parameter	Unit	Is
1.	**Processing lines**		
a)	volume of NPP V-1 concentrate processed	m^3	120
b)	volume of NPP A-1 concentrate processed	m^3	0
c)	volume of chrompik processed	m^3	3
2.	**BSC RAW**		
a)	pressing	t	37.1
b)	cementing	m^3	28.,5
c)	incineration – solid RAW	t	10.3
d)	FCC production	pcs	35
3.	**Quantities of spent fuel stored**		
a)	WWER fuel	pcs	5 382
b)	A-1 fuel	pcs	0

6.2 Some generally binding legal regulations concerning nuclear and radiation safety

Act No. 2/1993 Coll.ll. that amended and supplemented SNR Act No. 347/1990 Coll. on the organization of ministries and other state administration bodies of the Slovak Republic, as amended from time to time

Act No. 130/1998 Coll.LL. on peaceful uses of nuclear energy and on amendment and supplement to Act No. 174/1968 Coll. on state professional regulator of safety at work, as amended by Act No. 256/1994 Coll.LL., as amended by the most recent Act No. 470/2000 Coll.LL.

Act No. 50/1976 Coll. on physical planning and rules of construction (Building Code) – the most recent amendment by Act No. 237/2000 Coll.LL.

Act No. 70/1998 Coll.LL. on the energy system, and on amendment to Act No. 455/1991 Coll. on Small Trade Business (Small Trade Business Act), as amended from time to time; a new amendment is under way.

Act No. 254/1994 Coll.LL. on state fund of decommissioning nuclear power generating installations and treatment of spent nuclear fuel and radioactive wastes – most recent amendment No. 78/2000 Coll.LL.

Act No. 127/1994 Coll.LL. on environmental impact assessment, as amended most recently by No. 391/2000 Coll.LL.

Act No. 272/1994 Coll. on public health protection, as amended from time to time – the most recent amendment No. 470/2000 Coll.LL.

Act No. 42/1994 Coll.LL. on civil protection, the most recent amendment No. 252/2001 Coll.LL.

Act No. 95/2000 Coll.LL. on labor inspection

ČSKAE Decree No. 436/1990 Coll. on quality assurance of specified facilities from the aspect of nuclear safety of nuclear installations.

ČSKAE Decree No. 2/1978 on securing nuclear safety upon locating constructions with power generating nuclear facilities

ČSKAE Decree No. 4/1979, on general criteria of securing nuclear safety upon locating constructions with power generating nuclear facilities

ČSKAE Decree No. 6/1980, on securing nuclear safety upon start up and operation of power generating nuclear facilities. Only § 36 of Decree No. 6/1980 was abrogated by ÚJD Decree No. 245/1999 Coll.LL.

ČSKAE Decree No. 9/1985, on securing nuclear safety of research nuclear installations

SUBP Decree No. 66/1989 Coll. to secure nuclear safety of technical installations of nuclear power sector, as amended by Decree No. 31/1991 Coll.

ÚJD Regulation No. 29/1999 Coll.LL. that issues a list of special materials and equipment

ÚJD Regulation No. 30/1999 Coll.LL. that sets the details of maximum limits of quantities of nuclear materials which are not assumed to cause nuclear damage

ÚJD Regulation No. 186/1999 Coll.LL. that sets the details of the provision for physical protection of nuclear installations, nuclear materials and radioactive wastes

ÚJD Regulation No. 187/1999 Coll.LL. on professional competence of employees of nuclear installations

ÚJD Regulation No. 198/1999 Coll.LL. on accounting and control of nuclear materials

ÚJD Regulation No. 245/1999 Coll.LL. on emergency planning for the case of accidents and incidents

ÚJD Regulation No. 246/1999 Coll.LL. on the documentation of nuclear installations upon their decommissioning

ÚJD Regulation No. 284/1999 Coll.LL. on details of transportation of nuclear materials and radioactive wastes

ÚJD Regulation No. 31/2000 Coll.LL. on events at nuclear installations

ÚJD Regulation No.190/2000 Coll.LL. that sets the details of treatment of radioactive wastes and spent nuclear fuel

Regulation No. 453/2000 Coll.LL. that implements some provisions of the Building Code

Regulation No. 55/2001 Coll.LL. on territorial planning documents and physical planning documentation

Generally binding legal regulations abrogated or replaced (important amendments):

ČSKAE Decree No. 67/1987 Coll. on securing nuclear safety upon treating radioactive wastes was abrogated and replaced by ÚJD Regulation No. 190/2000 Coll LL. on treating radioactive wastes and spent nuclear fuel

ČSKAE Decree No. 100/1989 Coll. on security protection of nuclear installations and nuclear materials was abrogated and replaced by ÚJD Regulation No. 186/1999 Coll.LL. on securing of physical protection of nuclear installations, nuclear materials and radioactive wastes

ČSKAE Decree No. 191/1989 Coll. that sets the method, terms and conditions of verification of special competence of specified employees of nuclear installations was abrogated and replaced by ÚJD Regulation No. 187/1999 Coll. LL. on professional competence of employees of nuclear installations

Decree of Ministry of Health of the SSR No. 65/1972 Coll. on health protection against ionizing radiation was abrogated and replaced by Regulation No. 12/2001 Coll.LL. on requirements on securing radiation protection.

ČSKAE Decree No. 28/1977 Coll. on accounting and control of radioactive materials was abrogated and replaced by ÚJD Regulation No. 198/1999 Coll.LL. on accounting and control of nuclear materials

FZ ČSSR Act No. 28/1984 Coll. on state regulation of nuclear safety of nuclear installations was abrogated and replaced by Act No. 130/1998 Coll.LL. on peaceful uses of nuclear energy and on amendment and supplement to Act No. 174/1968 Coll. on state expert regulation of safety at work, as amended by Act No. 256/1994 Coll.LL.

FMTIR Decree No.84/1976 Coll. on territorial planning documents and planning documentation was abrogated by the most recent amendment to Building Code No. 237/2000 Coll. LL. and replaced by Regulation No. 453/2000 Coll.LL.

FMTIR Decree No. 83/1976 Coll. on general technical requirements on construction was abrogated by the most recent amendment to Building Code No. 237/2000 Coll.LL.

FMTIR Decree No. 85/1976 Coll. detailing regulations of location permit proceedings and rules of construction was abrogated by the most recent amendment to Building Code No. 237/2000 Coll.LL. and partly replaced by Regulation No. 453/2000 Coll.LL.

FMŽP, MŽP ČR and SKŽP Regulation No. 376/1992 Coll. LL. that amended and supplemented FMTIR Decree No. 83/1976 Coll. on general technical requirements on construction, as amended by Decree No. 45/1979 Coll. was abrogated by the most recent amendment to Building Code No. 237/2000 Coll.LL.

FMŽP, MŽP ČR and SKŽP Regulation No. 378/1992 Coll. that amended and supplemented FMTIR Decree No. 85/1976 Coll. detailing regulations of location permit proceedings and rules of construction, as amended by Decree No. 155/1980 Coll. was abrogated by the most recent amendment to Building Code No. 237/2000 Coll.LL. and partly replaced by Regulation No. 453/2000 Coll.LL.

ČSKAE Decree No. 6/1981, on testing of equipment for transportation and deposition of radioactive materials was abrogated and replaced by ÚJD Regulation No. 284/1999 Coll.LL.

ÚJD safety guidelines:

BNS I.4.1/1999 Single failure criterion

BNS II.5.1/1999 Welding at nuclear power installations (NPI). Basic requirements and rules

BNS II.5.2/1999 Supervision of the welding quality at NPI. Requirements

BNS II.5.3/1999 Requirements on welding additives at NPI

BNS I.9.1/1999 Safety of nuclear facilities during decommissioning

BNS III.4.1/2000 Requirements on UJD SR permit issue for fuel use in VVER 440 reactors

BNS III.4.3/2000 Requirements on assessment of fuel loading for VVER 440 reactors

BNS I.2.6/2000 UJD SR requirements on chapter 4 of Safety analysis report ”Core design”

BNS I.11.2/1999 Requirements for performance of safety analyses for ATWS

BNS II.3.1/2001 Evaluation of acceptability of faults detected during the operation inspection of nuclear installation selected equipment

6.3 List of some national and international documents relating to safety of WWER type reactors, (for the period between 1 July, 1998 – 30 June, 2001)

1.	NPP V-1 safety report after gradual upgrading	5/2001
2.	Pre-operation safety report for the national RAW repository	4/1999
3.	Pre-operation safety report – transportation of solid RAW in ISO containers	1/2000
4.	Pre-operation safety report – pre-qualified fragmentation site for processing of surface contaminated metallic RAW up to 3000 Bq/cm2	4/2001
5.	Pre-operation safety report for ISFSF	9/1998
6.	WENRA : Nuclear Safety in EU Candidate Countries	10/2000
7.	IAEA: Review of Results of the Gradual Upgrading at Bohunice WWER-440/230 NPP Units 1 and 2	11/2000
8.	Licensing Related Assessment of Design and Operational Safety for WWER 213 (PHARE/SK/TSO/VVER03)	12/1999
9.	Report on Nuclear Safety in the Context of Enlargement (9181/01)	5/2001
10.	International Conference on the Strengthening of Nuclear Safety in Eastern Europe – IAEA Report	6/1999
11.	Final Report of the IAEA EBP and other Related IAEA Activities on the Safety of WWER and RBMK NPPs	1998

6.4 6.4 Limits of radioactive substance discharges

Limit values for gaseous and liquid discharges are part of L&C approved by the regulator.

Table 6.4.1 shows values of discharge limits for NPP Bohunice and Mochovce, and Table 6.4.2 shows values for SE-VYZ operations.

TABLE. 6.4.1

Annual discharge limits						
	Ventilation stack				Liquid discharges	
	Rare gases (any mature)	Iodine (gaseous and airborne phase)	Aerosols – mixture of persistent radionuclides	Sr 89, 90	Tritium	Other corrosion and fission products
	Bq/year	Bq/year	Bq/year	Bq/year	Bq/year	Bq/year
Bohunice V-1	$4.1 * 10^{15}$	$6.75 * 10^{10}$	$1.8 * 10^{11}$	$1.35 * 10^{8}$		
Bohunice V-2	$4.1 * 10^{15}$	$6.75 * 10^{10}$	$1.8 * 10^{11}$	$1.35 * 10^{8}$		
Mochovce 1,2	$4.1 * 10^{15}$	$6.7 * 10^{10}$	$1.7 * 10^{11}$		$1.2 * 10^{13}$	$1.1 * 10^{9}$
Σ A1, V1, V2					$4.37 * 10^{13}$	$3.8 * 10^{10}$

	Daily discharge limits				Volume activity [Bq/m^3]	
	Rare gases (any mixture)	Iodines (gaseous and airborne phase)	Aerosolsy – mixture of persistent radionuclides	Sr 89, 90	Tritium	Other corrosion and fission products
	Bq/day	Bq/day	Bq/day	Bq/day	[Bq/m^3]	[Bq/m^3]
NPP V-1	$5.6 * 10^{13}$	$9.25 * 10^{8}$	$2.5 * 10^{9}$		$1.95 * 10^{8}$	$3.7 * 10^{4}$
NPP V-2	$5.6 * 10^{13}$	$9.25 * 10^{8}$	$2.5 * 10^{9}$		$1.0 * 10^{8}$	$2 * 10^{4}$
NPP Mochovce 1,2	$5.5 * 10^{13}$	$6.0 * 10^{9}$	$2.5 * 10^{9}$		$1.1 * 10^{8}$	$4 * 10^{4}$

TABLE 6.4.2

	Annual discharge limits for ventilation stack			Liquid discharges	
SE-VYZ	Aerosols – mixture of persistent radionuclides		Sr 89, 90	Volume activity	
	$\beta+\gamma$	α		Tritium	Other corrosion and fission products
	Bq/year		Bq/year	[Bq/m^3]	[Bq/m^3]
MGU	$9.4 * 10^8$	$8.8 * 10^6$	$2.8 * 10^7$	$1.95 * 10^8$	$3.7 * 10^4$
ISFSF	$3{,}0 . 10^8$				

	Weekly discharge limits for ventilation stack	
	Bq/week	
MGU	$9.0 * 10^7$	$8.5 * 10^5$
Bitumen-embedding line	$9.0 * 10^7$	$8.5 * 10^5$
ISFSF (daily limit)	$5.0 * 10^6$	

6.5 Author team

BALAJ Jozef	- Nuclear Regulatory Authority of the Slovak Republic
BEZÁK Stanislav	- Nuclear Regulatory Authority of the Slovak Republic
GIES František	- Slovenské elektrárne, a.s.
JURINA Vladimír	- Ministry of Health of the Slovak Republic
KOBZOVÁ Darina	- Ministry of Environment of the Slovak Republic
KONEČNÝ Ladislav	- Nuclear Regulatory Authority of the Slovak Republic
KUCHTA Ľubomír	- Nuclear Regulatory Authority of the Slovak Republic
LIPÁR Bernard	- Slovenské elektrárne, a.s.
LIPÁR Miroslav	- Nuclear Regulatory Authority of the Slovak Republic
METKE Eduard	- Nuclear Regulatory Authority of the Slovak Republic
NOVÁK Stanislav	- Nuclear Regulatory Authority of the Slovak Republic
ŠELIGA Mojmír	- Nuclear Regulatory Authority of the Slovak Republic
PARIMUCHA František	- Slovenské elektrárne, a.s.
POSPÍŠIL Pavol	- Slovenské elektrárne, a.s.
STUDENEC Ondrej	- Ministry of Economy of the Slovak Republic
TOMEK Jozef	- Slovenské elektrárne, a.s.
TURNER Mikuláš	- Nuclear Regulatory Authority of the Slovak Republic
UHRÍK Peter	- Nuclear Regulatory Authority of the Slovak Republic
ZEMANOVÁ Dagmar	- Nuclear Regulatory Authority of the Slovak Republic

and other contributors whom our thanks for the cooperation are due.

Translation:

ERBAN Milan - PT-Servis, s.r.o.