NATIONAL REPORT OF THE SLOVAK REPUBLIC

COMPILED IN TERMS OF
THE JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

APRIL 2003

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Abbreviations

ACST	Automated control system of technology
ALARA	As low as reasonable achievable
BCC	Bohunice Conditioning Centre
CA	Controlled area
CDE	Collective dose equivalent
CE	Classified equipments
CG	Core grid
Coll.	Statute book
CoS	Coolant system
CP	Civilian protection
CRAM	Capture radioactive material
CS	Control system
ČSFR	Czech and Slovak Federative Republic
ČSKAE	Czechoslovak Atomic Energy Commission
ČSSR	Czechoslovak Socialist Republic
DEC	District Emergency Commission
DGR	Deep geological repository
DRW	Definition of responsibilities at work
E	Event
EC	Emergency Commission of the Slovak Government
ECC	Emergency Control Centre
ECC ÚJD	Emergency and Co-ordination Centre of the Slovak Nuclear Regulatory Authority
EdF	Electricité de France
EGP	Energoprojekt (The general designer of nuclear power plant V1 and V2)
EPO	Extended planned overall repair
ERO	Emergency response organization
ES	Elementary system
FA	Fuel assembly
FCT	Fuerl rod Cladding leakage Test
FFS	Fresh fuel storage
FRC	Fibre-reinforced concrete container
FTT	Full train tests
Fund	State Fund of Nuclear Facility Decommissioning
HC	Hermetic container
HCDL	High-capacity decontamination line
HM	Heavy metal

HNMA	Head of Nuclear Material Accounting
HP	Handling procedure
HRAW	High level radioactive waste
IAEA	International Atomic Energy Agency
ICRP	International Commission for Radiation Protection
IDE	Individual dose equivalent
IFCI	Inspection of fuel cladding integrity
INES	International Nuclear Event Scale
INSAG	International Nuclear Safety Advisory Group
IRAW	Institutional radioactive waste
ISAR	Initial Safety Analysis Report
L&C	Limits and conditions
MoEc	Ministry of Economy of the Slovak Republic
MoEn	Ministry of Environment of the Slovak Republic
MoH	Ministry of Health of the Slovak Republic
MoI	Ministry of Interior of the Slovak Republic
MoL	Ministry of Labour, Social Affairs and Family of the Slovak Republic
NF / NPF	Nuclear facility / Nuclear power facility
NFC	Nuclear fuel cycle
NCHI	State Faculty Health Institute
NLI	National Labour Inspectorate
NM	Nuclear material
NPP	Nuclear power plant
NPP A1	Nuclear Power Plant Bohunice A1
NPP Mochovce	Nuclear Power Plant Mochovce
NPP V1	Nuclear Power Plant V1 Jaslovské Bohunice (Unit 1&2)
NPP V2	Nuclear Power Plant V2 Jaslovské Bohunice (Unit 1&2)
NR	National report
NRR	National radwaste repository
NUF	Nuclear fuel
NUSS	Nuclear Safety Standards
OCP	Office of Civilian Protection at the Ministry of Internal Affairs of the Slovak Republic
OH&S	Safety and health protection at work
OMG	Operative-managing Group
OP	Operational manual
PHARE	EU initiative for the reconstruction of economy of central and east European countries
PO	Planned overall repair
PoSAR	Pre-operational Safety Analysis Report

PR	Planned repair
PRG	Program
PSA	Probabilistic safety assessment
PT	Preoperational tests
QA	Quality assurance
QA-NF	Code of fuel cycle in the quality assurance system
QAS	Quality Assurance Standard
QS	Quality system
R	Reactor
Ra	Radioactive
RAW	Radioactive waste
RB	Reactor building
RC	Reactor core
RE	Refurbishment
REC	Regional Emergency Commission
ReF	Refuelling
ReP	Refuelling pool
RH	Reactor hall
RM	Refuelling machine
RP	Inspection physicist
RS	Radiation safety
RV	Reactor vessel
SAR	Safety Analysis Report
SE, a. s.	Slovenské elektrárne, joint-stock company
SE-EBO	Nuclear Power Plant Jaslovské Bohunice, subsidiary of SE, a. s.
SE-EMO	Nuclear Power Plant Mochovce, subsidiary of SE, a. s.
SE-VYZ	Decommissioning of the Nuclear Facilities, Radioactive Waste and Spent Fuel Management, subsidiary of SE, a. s.
SF	Spent fuel
ISFS	Interim Spent fuel storage
SFP	Spent fuel pool
SHMI	Slovenský hydrometeorologický ústav (Slovak Hydro-Meteorological Institute)
SHRMN	Slovak Headquarters of Radiation Monitoring Network
SR	Slovak Republic
SRAW	Solid radioactive waste
STS	Slovak Technical Standard
TC	Transport container
TD	Technical documentation

TE	Transporation equipment
TeI	Technical inspection
t_{HM}	Tons of heavy metal
TK C-30	Transport container for spent fuel - type C-30
TOP	Technological operating procedure
TP	Technological procedure
TS	Technical safety
TSSM	Technical specification of safety measure
TV	Television
ÚJD SR	Nuclear Regulatory Authority of the Slovak Republic
US	Universal shaft, shaft No. 1
US NRC	United States Nuclear Regulatory Commission
VÚJE	VÚJE Trnava, a. s. – engineering, design and research institute
WANO	World Association of Nuclear Operators
WW	Water work
WWER	Pressurised water reactor
ZSSR	Soviet Union
ŽSR	Railway of the Slovak Republic

A. Introduction

The Slovak Republic ratified the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereafter “Joint Convention”) on 6-th October 1999. The National report was elaborated based on the Article No. 32 of the Joint Convention and its structure complies with the recommendations of the Guidelines regarding the Form and Structure of National Reports.

There are six nuclear units in operation in Slovakia at the present. All of them are equipped with reactors WWER-440. Four units are installed at Jaslovské Bohunice (EBO 1-4, called NPP V1 and NPP V2) and two of them at Mochovce (EMO 1-2).

Nuclear power plant A1 located at Jaslovské Bohunice was designed to use natural uranium as fuel in a heawy water reactor cooled with carbon dioxide (HWGCR – 150MW). This power plant was shut down in 1977 after and accident (INES 4) and it is in the first stage of decommissioning at the present. The spent fuel from this plant was transported to the Russian Federation based on a valid contract.

The technology designed for radioactive waste management are located at Jaslovské Bohunice and Mochovce. The technology for radioactive waste conditioning is part of the so-called Bohunice Conditioning Centre (BCC) which is in operation since 1999 and uses several technologies for waste treatment. There are also experimental radioactive waste treatment technologies installed at Jaslovské Bohunice.

The National Radwaste Repository of low and intermediate level waste (NRR) was put into operation near Mochovce in 1999.

An interim spent fuel storage is in operation at Jaslovské Bohunice since 1987. The seismic resistance and storage capacity of this facility was already enhanced.

More details on the technologies used for the spent fuel management and radioactive waste management can be found in the next chapters of this report.

SE, a. s. and VÚJE are the only operators of nuclear facilities in the Slovak Republic.

The state supervision of nuclear safety on spent fuel management and radioactive waste management is performed by the Nuclear Regulatory Authority of the Slovak Republic (ÚJD SR). The basic law for the peaceful use of nuclear energy is Act No. 130/1998 Coll. (so-called Atomic Act). ÚJD SR is an independent state authority headed by the chairperson with a significant delegated power according to the legislation. She has a direct access to the government. The state supervision on the radiation protection is assured by the State Faculty Health Institute (NCHI) in compliance with the Act No. 272/1994 Coll. as amended.

Work inspection (especially on the safety and health protection at work and safety of equipment) is performed by the National Labour Inspectorate (NLI) in compliance with the Act No. 95/2000 Coll. related to the inspection of work and in compliance with the Act No. 231/2002 Coll. The fulfilment of requirements on safety of technical equipments is verified by the Technical Inspection in compliance with the Act No. 330/1996 Coll. as amended.

The Slovak Republic joined all the significant international agreements and conventions in the field of peaceful use of nuclear energy.

A list of nuclear facilities according to the Join Convention is presented in Annexes L (I), (II), (III).

B. Policies and Practices

B.1. Spent fuel management

The basic policy of spent fuel and radioactive waste management is established by the Resolutions No. 930/1992, No. 190/1994 and No. 5/2001 of the Slovak government.
In 1997 the Slovak government accepted the Updated Power Policy of SE, a. s. till year 2005. The related government Resolution No. 684/97 includes the provisions on the spent fuel management.

In 2000 the Slovak government adopted the Power Policy of the Slovak Republic that also relates to the concept of fuel cycle back-end.
The current basic concept of spent fuel management at SE, a. s. and in the Slovak Republic resulting from the documents above and updated by the SE, a. s. management can be characterized as follows:

1. The operation of nuclear reactors in Slovakia adopts an open fuel cycle. At the present time, it is impossible to apply a closed fuel cycle in Slovakia since the reactors WWER-440 are not licensed to utilise MOX fuel in Slovakia.
2. For the management of spent fuel a transport of spent fuel into foreign countries followed up by an import of reprocessed products (Pu, U, HRAW) into SR is not considered.
3. Short-term storage of spent fuel (3 to 7 years after it has been removed from the reactor core) is assured in the pools located at the reactors (SFP) installed at each reactor unit.
4. Long-term storage of spent fuel (40 to 50 years after its removal from the reactor) is secured by separate storage facility at Bohunice.
5. A long-term goal within the concept of spent fuel management is a construction of deep geological repository of SF and HRAW in the Slovak Republic.
6. To verify the possibility of transporting the spent fuel into foreign countries for final disposal or reprocessing without importing the products back into Slovakia.
7. In future, to verify the possibility of international or regional solution on the final spent fuel disposal and to follow the new technologies in the area of spent fuel management.

Long-term spent fuel storage (40 to 50 years after its removal from the reactor), which is required before conditioning and putting the spent fuel into a repository, will be carried out in separate spent fuel storage facilities at Jaslovské Bohunice and Mochovce. An interim spent fuel storage facility (IISFS - SE-VYZ) is in operation at Jaslovské Bohunice since 1987. ISFS - SE-VYZ was already reconstructed in order to increase its storage capacity. A project to enhance its seismic resistance and to improve its safety was accomplished in 1999. A project of spent fuel storage facility at Mochovce (ISFS - EMO) is currently in first stage of investment implementation.
All spent fuel assemblies from the A1 reactor unit (HWGCR reactor, in operation since 1973 till 1977) were transported to the Russian Federation till July 1999. Before 1987 a small number of spent fuel assemblies from WWER-440 reactors (697 fuel assemblies) were also transported to the Russian Federation.
There is a correspondence between SE, a. s. and several organizations in the Russian Federation (MINATOM, OAO TVEL) in order to verify the possibility of transporting the spent fuel for reprocessing into the Russian Federation without returning the resulted products back into the Slovak Republic. Proposal for such transportation was indicated by the Russian side already.
In 2001, the Slovak government in his Resolution No. 5/2001 accepted “The proposal on the schedule of economical and material solution on the management of spent fuel and decommissioning process of nuclear facilities” and assigned to submit a “Policy of decommissioning of nuclear facilities and management of spent fuel evaluated according to the act on environmental impact assessment” for a discusion on government level by 31. 12. 2007.

B.2. Radioactive waste management

The current policy of radioactive waste management in Slovakia was approved by the Resolution No. 190/94 of the Slovak government and after its update it can be characterized as follows:

1. Effectively use the current equipment for radioactive waste treatment and conditioning installed at Jaslovské Bohunice site.
2. Basic solidification methods of liquid radioactive waste, radioactive sludge and exhausted ion-exchanging resins into a form suitable for final disposal include cementation and bitumenation.
3. The volume of solid radioactive waste will be minimised by applying compaction and incineration.

4. The treated radioactive waste is than grouted by active mixture of concrete and concentrate into fibre-reinforced concrete containers. These containers are suitable for transportation as well as for storage and disposal.
5. For treatment of intermediate level waste and radioactive waste with high contents of trans-uranium (specific liquid radioactive waste produced during the storage of spent fuel at Nuclear Power Plant A1 that is in form of sludge and chrompik) is necessary to apply a vitrification method.
6. Low-active soil and concrete rubble shall be arranged into layers on supervised stock-piles.
7. The available methods (high-pressure compaction, cementation, etc.) shall be used for the treatment of metal radioactive waste. Because of the increasing trend of metal radioactive waste production a melting unit shall be installed and used for its conditioning. The low-activity metal waste shall be treated by applying fragmentation and decontamination and cleaned material can be than released into the environment.
8. Methods and technology of releasing materials (especially construction materials) into the environment shall be resolved.
9. Institutional radioactive waste shall be treated and conditioned into a form acceptable for disposal by applying standard methods for treatment of radioactive waste produced by nuclear facilities. The disused sealed sources shall be conditioned into a form suitable for centralised long-term storage or disposal.
10. Long-lived storage of radioactive waste is allowed only in specially adapted areas approved by the regulatory authorities. The radioactive waste, which is dedicated for long-lived storage, shall be disposed in solid form and in suitable containers.
11. The conditioned radioactive waste produced during the operation and decommissioning of nuclear power plants and the conditioned institutional radioactive waste that meet the acceptance criteria shall be disposed of in the National Repository Mochovce.
12. The waste which is not acceptable for the National Repository Mochovce shall be stored at the power plants. An integral storage shall be installed at Bohunice to allow storing of radioactive waste that is not acceptable for NRR.
13. The radioactive waste which does not meet the criteria for disposal in near surface repository shall be disposed of in deep geological repository, a deep geological repository shall be built.
14. Transport of radioactive waste shall be carried out exclusively by using packaging and transporting equipment approved for this purpose.
15. The costs of radioactive waste management produced during the decommissioning of nuclear power facilities shall be covered from the resources of Fund. The costs of radioactive waste management produced during the operation of nuclear power plants shall be covered by the operational costs of these power plants.

B.3. Criteria used for the definition and classification of waste

Radioactive waste in the Slovak Republic is defined as unusable material that cannot be released into the environment because of the content of radionuclides or contamination by radionuclides. The limiting concentrations for the individual radionuclides allowing to release these materials into the environment are defined by the Regulation No. 12/2001 Coll. of MoH SR.

Classification of radioactive waste is based on the disposal principle and it is defined by the Regulation No. 190/2000 of ÚJD SR. This regulation distinguishes the following categories of radioactive waste:

a) **Transitional radioactive waste**, activity of which decreases during the storage period below the limit value and then it is possible to release it into the environment,

b) **Low-level radioactive waste and intermediate radioactive wastes**, activity of which is higher than the limit value for release into the environment and the produced residual heat is less than 2 kW/m^3 :

   1. **short-lived** radioactive waste, which after conditioning meets the acceptance criteria for near surface repository of radioactive waste and which average activity concentration of alpha nuclides is less than 400 Bq/g,

   2. **long-lived** radioactive waste, which after conditioning does not meet the acceptance criteria for near surface repository or which average activity concentration of alpha nuclides is higher than or equal to 400 Bq/g,

c) **High-level radioactive waste**, which produces residual heat higher than or equal to 2 kW/m^3.

It has not been defined yet when the spent fuel becomes a high-level radioactive waste.

C. Scope of Application

C.1. Safety of spent fuel management

The scope of this report comprises the information on the safe management of spent fuel produced at nuclear facilities of SE, a. s. including the transportation and inventory of spent fuel.
The most significant facilities of SE a. s. from the spent fuel management point of view are as follows:

- Nuclear Power Plant Bohunice, subsidiary of SE, a. s. (SE-EBO) - NPP V1 (Unit 1&2), NPP V2 (Unit 3&4)
- Nuclear Power Plant Mochovce, subsidiary of SE, a. s. (SE-EMO, - Unit 1&2,
- Decommissioning of the Nuclear Facilities, Radioactive Waste and Spent Fuel Management, subsidiary of SE, a. s. (SE-VYZ) – Interim Spent fuel storage (ISFS-VYZ)

At present there are neither facilities for the reprocessing of spent fuel nor equipment for management of high-level waste and other products of spent fuel reprocessing (plutonium, uranium) in the Slovak Republic. Reprocessing of spent fuel is not included into the concept of spent fuel management (see chapter B.1.). Currently, the spent fuel produced by nuclear power plants of SE, a. s. is not reprocessed in foreign countries with the intent to return the product back to the Slovak Republic. The spent fuel from Nuclear Power Plant A1 and portion of the spent fuel from WWER-440 reactors was in the past transported into the former Soviet Union without returning the high-active radioactive waste after reprocessing back into the Slovak Republic.

C.2. Safety of radioactive waste management

The scope of this report comprises the information on safe management of radioactive waste produced at the nuclear power facilities of SE, a. s. including the transportation and inventory and information on management of radioactive waste produced by use of radiation sources. The waste that was not produced in frame of nuclear fuel cycle and that contains only natural radioactive nuclides is not covered by this report and it is not included into the presented inventory of radioactive wastes.

SE, a. s. is the operator of the most significant facilities from the radioactive waste management point of view:

- Nuclear Power Plant Bohunice, subsidiary of SE, a. s. (SE-EBO) - NPP V1 (Unit 1&2), NPP V2 (Unit 3&4)
- Nuclear Power Plant Mochovce, subsidiary of SE, a. s. (SE-EMO) - Unit 1&2,
- Decommissioning of the Nuclear Facilities, Radioactive Waste and Spent Fuel Management, subsidiary of SE, a. s. (SE- VYZ) the following technologies:
  - NPP A1(under decommissioning)
  - Technologies for the treatment and conditioning of radioactive waste,
  - National Radwaste Repository
- **VÚJE** is the operator of an experimental incinerator equipped with an experimental cementation equipment and experimental bituminization plant.

D. Inventories and Lists

D.1. List and description of equipment for spent fuel management

Slovenské elektrárne, joint-stock company is in compliance with the Article No. 2 of the Joint Convention an operator of the following nuclear facilities via of his branches:
SE-EBO is operator of:

- Nuclear Power Plant Bohunice, subsidiary of SE, a. s. - units V1
- Nuclear Power Plant Bohunice, subsidiary of SE, a. s. - units V2
- SE-EMO is operator of:
- Nuclear Power Plant Mochovce, subsidiary of SE, a. s. - unit 1 and 2
- SE-VYZ is operator of:
- Interim Spent fuel storage (ISFS-VYZ)

D.1.1 Basic characteristics of SE-EBO and SE-EMO main equipment

Refuelling machine (RM)

All the manipulations with the spent fuel assemblies (under water dilution with content of H_3BO_3) in the refuelling pool, spent fuel pool and transport container pool are carried out by refuelling machine by means of telescopic arm and special fixtures. For the events of high seismic activity exceeding the limit value, the refuelling machine at SE-EMO is equipped with an anti-seismic halting system. The refuelling machine at SE EBO does not have this system installed yet. The control system of refuelling machine is outfit with interlocks protecting the transported spent fuel while the refuelling machine can operate in manual, semi-automatic or automatic mode. The refuelling machine can be controlled from a cab or from a remote control room of refuelling machine.

Spent fuel pool (SFP)

The spent fuel is at nuclear power plants stored in the spent fuel pool that is located next to the reactor. There is no drainage designed to the spent fuel pool. The walls and bottom of spent fuel pool at SE-EMO are equipped with two linings. The space between these linings is continuously monitored to reveal any leakages on the inner wall. The spent fuel pool at SE-EMO is equipped with only one lining – a simple 3 mm stainless steel lining.
Nominal temperature 50°C inside the spent fuel pool is secured by means of two independent cooling systems. Each of them is capable to remove the residual heat generated by the spent fuel stored inside the base grid and to handle the maximum heat load during an operative removal of all fuel assemblies from the reactor vessel into a standby grid.
The spent fuel is stored inside a base grid located in the bottom area of the spent fuel pool. The base grid of all units at SE-EBO was designed to store 319 spent fuel assemblies and 60 hermetic casings for defective fuel assemblies.
Change No. 406/P was approved at both SE-EMO units in 1990 in order to increase the storage capacity of spent fuel pool by installing a more compact base grid.
Based on this change, all the parameters related to cooling, environment protection and seismicity were re-calculated. It was confirmed that the existing systems are sufficient even for the increased amount of stored spent fuel. According to these calculations a new compact grid was designed and manufactured with capacity of 603 fuel assemblies and 54 hermetic casings. A new individual quality assurance program No. A19 was approved and implemented for the enhanced compact grid in compliance with the Decision No. 105/97 of ÚJD SR.
Once the outage has been completed the spent fuel pool is closed by a covering and then sealed by IAEA seal. The stored spent fuel is subject to recording and supervision by ÚJD SR and IAEA.

Standby grid of spent fuel pool

This grid is used for the storage of spent fuel assemblies removed from the reactor core during planned overhauls when the capacity of lower grid has been exhausted and no more assemblies can be stored in the base grid.

Spent fuel pool covering

The covering serves as an mechanical restraint against entering objects into the spent fuel pool and as shield against ionising radiation coming from the spent fuel pool.

Barrier gate sealing the transport channel

It separates the spent fuel pool from the refuelling pool and prevents water to leak from the spent fuel pool into the refuelling pool. At the same time it serves as shied against ionising radiation.

Transport container shaft

A universal double-purpose stand is located in the transport container shaft serving as storage place for fresh fuel cartridge and for the transport container used for the removal of spent fuel from the reactor unit.

At SE-EMO, anti-seismic devices are installed into the transport container shaft to fix the transport container in place.

Transport container stands

After removing the transport container from its shaft, it is placed on a stand below TC. There are three stands installed at the SE-EMO reactor hall and one stand at SE-EMO reactor hall, which will be used to seal and perform thermal stabilisation of TC.

Suspension of spent fuel transport container

The spent fuel transport container is by means of a hoisting device and suspension placed into the transport container shaft, into stabilisation lots located in the reactor hall or into a wagon.

Inspection shaft

It is designed for the decontamination of transport containers.

Hermetic casing for defective fuel assemblies

These casings are used to store the fuel assemblies with defective fuel cladding. They have two functions. The first one is to store the defective assemblies and the second one is to transport the defective fuel. The casing is designed to reduce the level of ionising radiation and radioactive nuclides coming from defective fuel assemblies.

Platform located above the transport container shaft

This platform helps to navigate the suspension of transport container while lifting it by a hoisting device to the container located inside the transport container shaft and when putting the container into the shaft's nest.

Platform for the spent fuel transport container in the reactor hall

The personnel employs this platform to manipulate with the container's lid and with the measurement monitoring the conditions inside the spent fuel container.

Spent fuel container stand

The spent fuel container is placed onto this stand during the stabilisation period in the reactor hall.

Electric bridge crane 250/32/2 t

Transportation of spent fuel containers from the SE-EBO and SE-EMO reactor units to the shipping equipment located in the transport corridor of the particular unit will be carried out by means of a bridge crane with capacity of 250 t and using the transport container suspension.

The crane is equipped with micro-shifts and micro-lifts and it can be controlled locally as well as from a remote location. The spent fuel container is transported along a specified path while kept in specified height. The transport path inside the reactor hall was enhanced to resist a drop of heavy load by installation of damping plates. Lowering of transport container from the elevation 18.9 m into the transport corridor is carried out above a damping device located in a special wagon. The spent fuel transport container is then placed onto a towing car or wagon to be transported into ISFS.

Because of the concept of modernisation of reactor units and safety enhancement programs adapted at NPP V1 and V2 and based on the analysis of several significant operating events, there were performed several modernisations of transportation equipment of spent fuel treatment since putting NPP V1 and V2 into operation till 2002.

The most significant modifications at NPP V1 and V2 are as follows:

- Modernisation and refurbishment of electrical part of TV system and control system of refuelling machine (automated process control with the option of manual, emergency or simulation operating mode of refuelling machine).
- Installation and repair of fuel cladding monitoring system in the reactor core – "Sipping in-core test".

- Installation of a special semi-automatic manipulator for the removal of alien objects from the reactor vessel and inner parts of reactor.
- Installation of safety remote electric control of retainers of the suspension of spent fuel transport container.
- Safety enhancement of navigation of TC C-30 to UH at NPP V1, V2.
- Installation of a portable heater of demineralised water for TC C-30.
- Installation of new hardware and software for the leak monitoring from SFP NPP V1.

The main criteria for these modifications were restriction of human errors at operating events, enhancement of safety during the manipulation with spent fuel, equipment reliability, safe operation of TE and overall safety of reactor units NPP V1, V2.

D.1.2 Interim Spent fuel storage SE-VYZ (ISFS-VYZ)

According to the original design of WWER-440 units the spent fuel after three years of storage in the spent fuel pool should be transported to the former Soviet Union for reprocessing. Later on the Soviet side required to store the spent fuel on the plant for at least ten years. That's why an Interim Spent fuel storage was designed and constructed at Jaslovské Bohunice in 1986 to satisfy the needs of SE-EBO.
In contrary to SE-EMO the spent fuel pool at SE-EBO was not transformed into a compact form but the spent fuel from SE-EBO units is after 2.5 to 3 years storage in the pool next to the reactor transported into the Interim Spent fuel storage.
The Interim spent fuel storage is located to the JE Bohunice site. It is a nuclear facility for safe storage of spent fuel from the WWER reactor before deposition for final disposal or before reprocessing. The Interim storage of spent fuel was put into operation in 1986.
The ISFS facility is in separate building with not link to the other buildings of Bohunice Nuclear Power Plant. The building consists of a container section and storage section. The storage section consits of four storage pools. One of them is in standby mode. The storage pools are cross-connected with a transport channel. The individual pools can be isolated from the transport channel by hydro gates. The transport channel is joined to the receiving and transfer shaft and can be also isolated by hydro gates. The spent fuel is stored inside containers located under-water in the individual pools. The water serves as shielding against radiation and as coolant for the removal of residual heat from the spent fuel assemblies.

Storage pools

There are four storage pools in the pool hall of ISFS. One of them is a standby pool. The pool's bottom is at elevation ±0.00m and the pool's covering at elevation +7.20 m. The water level in the pool is kept at elevation +6.3 m.

The pools are outfit with two linings (first is made of carbon and the second one of stainless steel) creating a space between them and the leak from this space is directed into a system of organised leaks. All pools are covered with coverings equipped with uncovering segments that exactly determine the container transportation path and secure precise location when the container shall be placed into the storage pool. The pool's covering can be sealed individually or by sections. The individual pools can be isolated from the transport pool by isolation gates. The storage capacity of each pool is 56 containers T-12 or T-13 (14 rows with 4 containers in each), or 98 compact containers KZ-48 (14 rows with 7 containers in each). Storage capacity of container T-12 and T-13 is 30 fuel assemblies and the capacity of compact container KZ-48 is 48 fuel assemblies. The total storage capacity of ISFS is 14 112 fuel assemblies from reactors WWER-440. While the containers are transported they are kept no more than 600 mm above the bottom of transporting pool or storage pool.

The total capacity of ISFS is continuously increasing by replacing the old containers T-12 (capacity of 30 assemblies) with new containers KZ-48 (capacity of 48 assemblies) and will be sufficient to store all the spent fuel produced by units NPP V1 and NPP V2. The replacement of old containers is foreseen to be completed by year 2007. After the refurbishment and replacing of all containers by the new type KZ-48 the storage capacity of ISFS VYZ can reach 14 112 fuel assemblies (1 694 t of heavy metal).

ISFS is equipped with its own **cooling and purification station**. Since of the increased requirements on the heat sink for the removal of residual heat generated by spent fuel (greater depletion, more spent fuel assemblies), the original cooling system was replaced by a new one. The new cooling system includes two panel coolers (one is in standby mode) and four pumps (one for each pool while the pump belonging to the standby pool is in standby mode). The heat removal from the cooling water can be assured also by a separate autonomous cooling system of cooling water that consists of three cooling micro-towers and two circulation pumps (one in standby mode). The cooling station is operated periodically based on the actual needs of pools' cooling water to keep its temperature within the required region.

The purification station is designed to keep the water quality inside the pools on required level. This is assured by mechanical filters and ion exchangers. The purification station is operated periodically.

Transport container C-30

It is designed for on-site shipment of spent fuel from SE-EBO to ISFS SE-VYZ or for spent fuel transport outside the nuclear power plants. During a shipment the transport container is placed on a special wagon. In ISFS and RB the transport container is transported by using the transport container's suspension.

The fuel during the shipment is kept in suitable environment with nitrogen cushion (wet transport) or cooled by nitrogen (dry transport).

BASIC TECHNICAL DATA OF ISFS JASLOVSKÉ BOHUNICE	
Storage capacity by 31.12.2002	6 696 fuel assemblies
Number of pools	3 in operation + 1 standby
Ground-plan	46m x 69m
Total built-up area	95 000m^2
Capability of extension	2 to 3 pools
Storage method	In containers T 12, T 13,KZ 48
Maximum water temperature in pools	50 °C
Capacity of pool water purification system	2 x 40 m^3/hod
Method of spent fuel shipment	wagons, containers TC C-30
Size of pool, length x width x depth	23 x 8,6 x 7 m
Number of containers per pool	56
Design capacity of cooling system	2 533 kW

Seismic re-enforcement and increasing of storage capacity of ISFS-VYZ

By implementing of such modifications to ISFS (refurbishment of ISFS) the original capacity of ISFS VYZ can increase up to 14 112 fuel assemblies (1 694 t of heavy metal uranium). The need to increase the storage capacity of ISFS resulted from the number of fuel assemblies already stored and from the analysis of amount of spent fuel assemblies produced during the foreseen operation of units V1 and V2. The storage capacity of ISFS was increased by using compact containers (KZ-48) and by modifying the existing technologies and safety systems of ISFS. The originally used container T-12 allows to store 30 fuel assemblies and up to 56 containers can be places into one pool. The new compact container KZ-48 is capable to store 48 fuel assemblies. Its profile allows to arrange the containers in the pools closer one next to the other, so up to 98 compact containers can be placed into one pool. The increased storage capacity of ISFS will assure the possibility to store the spent fuel produced during the foreseen operation of NPP V1 and V2.

This enhancement of ISFS's storage capacity at the same time meets the requirement of ISFS seismic re-enforcement as well as the latest knowledge in this area.

The ventilation system assures ventilation of internal areas of ISFS and continuous monitoring of radioactive aerosols in the releases. The ventilation system capacity is 127 000 m^3 / hour.

The original design of ISFS followed the former Czechoslovak standards (ČSN 730036 – Seismic load of civil structures) valid at that time and does not meet the current requirements on seismic resistance of nuclear facilities.

The objective of ISFS seismic re-enforcement project was to enhance the resistance of civil structures and technological devices up to the level of international guidelines and requirements in accordance with the performed geological and seismic surveys. Since the evaluation of these surveys carried out by SAV was not available at the time when the project was prepared, the layout prepared by EQE International was used for this enhancement as well as for the seismic re-enforcement of other facilities (NPP V1, V2) at Jaslovské Bohunice at the present. The seismic equipment is in more details defined in the report prepared by EQE International in September 1996 (EQE Project Number 745 009.01).

Classification of civil structures, technological devices, electric equipment and instrumentation and control systems was performed based on the methodology of "Requirements" – Category 1 (1a, 1b, 1c) on Review Level Earthquake (RLE). Evaluation of calculations resulted in required modifications to the civil structures and technology. These modification have been than implemented in frame of "Seismic re-enforcement and increasing of storage capacity of ISFS Bohunice".

After implementing the project above all the safety functions of ISFS will be preserved even after an seismic event and the storage capacity will be sufficient to store all the spent fuel assemblies produced by NPP V1 and V2 during their whole life time.

In addition to the modifications of original architecture and technology of ISFS which resulted from the requirements on seismic re-enforcement and increasing of storage capacity (licensed container KZ-48) and representing the main objectives of re-construction, there were also implemented modifications aiming to enhance the technical and safety level of ISFS:

- Installation of a manipulator MAAP 400 for moving the spent fuel from one place to another
- Enhancement of air-conditioning systems for control room, ventilation of ISFS entrance, modification of ventilation systems resulting from the modification of hygienic loops, ventilation of emergency exits (stairway) based on the requirements raised by fire prevention
- Enhancement of pool water filtering by installing a filtration unit to capture micro-organisms in pool water, including the disposal of filtration cartridges
- Modification of decontamination system
- Installation of a spent fuel cladding test system (Sipping in Pool) and monitoring of corrosion of pool linings
- Modernisation of ISFS radiation monitoring system and instrumentation
- Modification of the hygienic loop arrangement located at elevation ±0.00 m and +3.60 m
- Modification of the entrance for the personnel into the ISFS building
- Modification of civil structures resulting form the installation of new technology
- Monitoring of persistence of civil structures and technology including the monitoring of spent fuel condition

Monitoring program

Based on the IAEA recommendations and ÚJD SR resolution a new monitoring program is gradually implemented since 2001 to monitor the condition of civil structures, technology and spent fuel. This program is targeted to monitor:

- Such civil structures as foundation of ISFS building, concrete structures of spent fuel pools, steel frame structures and shell of ISFS building,
- Pressure vessels and piping (cooling, purification and decontamination system),
- Damages due to corrosion of equipment and technology that is in contact with spent fuel pool coolant (construction of pools, transport equipment),
- Rotary machines (selected pumps and fans),
- Systems and components of electric power supply (transformers, generators, drivers and cables),
- Spent fuel.

New monitoring points will be installed to monitor the progressive settlement of ISFS building. Also the level of underground water will be monitored. Condition of ISFS pool lining is monitored via material specimens placed into the pools and by utilising the method of acoustic emission. System of fuel cladding test is used to monitor the condition of spent fuel (Sipping in Pool) and a new inspection stand will be installed to monitor the spent fuel by performing non-destructive tests of nuclear fuel pellets.

D.2. List and description of radioactive waste management facilities

Slovenské elektrárne, a. s. (via its subsidiaries) and VÚJE are in compliance with Article No. 2 of the Joint Convention operators of the following nuclear facilities for radioactive waste management:

SE-EBO is the operator of the following facilities:

- Nuclear Power Plant Bohunice, subsidiary of SE, a. s. - NPP V1, WWER-440 (V 230)
- Nuclear Power Plant Bohunice, subsidiary of SE, a. s. - NPP V2, WWER-440 (V 213)
- SE-EMO is the operator of the following facilities:
- Nuclear Power Plant Mochovce, subsidiary of SE, a. s. - Unit 1&2, WWER-440 (V 213)
- SE-VYZ is the operator of the following facilities:
- Nuclear Power Plant A1 – in decommissioning phase, without spent fuel
- Technologies for radioactive waste treatment and conditioning
- National Repository for low and intermediate level radwaste
- VÚJE is the operator of following facilities at Jaslovské Bohunice
- Experimental incinerator of radioactive waste with additional cementation facility
- Experimental bituminization plant

D.2.1 Equipment of SE, a. s. for radioactive waste management at nuclear power plants with WWER reactors

Equipment for solid radioactive waste management includes collection equipment, sorting equipment, washers, dryers, low pressure compactor and fragmentation equipment. These are used for the fragmentation of large pieces of solid metal radwaste (SRAW) and they are equipped with clippers, point lathe and hydraulic frame saw. There is installed one common work place for both SE-

EBO nuclear power plants. SE-EMO is equipped with hydraulic clippers for fragmentation of metal waste and disk-type saw for fragmentation of soft SRAW.

Equipment for liquid radioactive waste management includes purification (filtrating) stations with ion exchange resins, evaporators, storage tanks for non-treated liquid radioactive waste and concentrates and purification stations of contaminated oils.

Equipment for gaseous radioactive waste management includes ventilating systems equipped with aerosol and iodine filters.

Equipment for SRAW storage

The method used to store SRAW is function of SRAW's type and type of packagings (overpack). SRAW at SE-EBO is stored in the following packaging:

- MEVA drum with capacity of 200 l – SRAW designated for incineration or high pressure compaction,
- enclosed palettes – metallic SRAW only at NPP V2 and SE-EMO,
- special packaging – e.g. high-level SRAW from reactors is stored in cylindrical containers made of stainless steel,

other SRAW with higher activity in shielded drums and ventilation filters in metal packagings,

- free-storage is applied for large pieces of SRAW.

Medium-level radioactive waste from reactor is stored in stainless steel containers placed in special storage that is accessible directly from the reactor hall. The storage place is built up from vertical metal shafts embedded into concrete in order to assure shielding against the radiation.

Equipment for liquid radioactive waste storage

Concentrate is stored in stainless steel tanks with capacity of 415 to 550 m^3 placed into isolated concrete shafts capable to store the whole content of tanks in case of failure.

There are installed 10 tanks at NPP V1 with total capacity of 4215 m^3.

There are installed 9 tanks at NPP V2 with total capacity of 4860 m^3.

SE-EMO has installed 5 tanks with total capacity of 2660 m^3.

Exhausted ion-exchanging resins are stored in stainless steel tanks with capacity of 150 to 450 m^3 placed into isolated concrete shafts capable to store the whole content of tanks in case of failure.

There are installed 5 tanks at NPP V1 with total capacity of 1584 m^3.

There are installed 3 tanks at NPP V2 with total capacity of 1380 m^3.

SE-EMO has installed 4 tanks with total capacity of 1840 m^3.

Contaminated oils are stored in MEVA drums with capacity of 0.2 m^3 and containers with capacity of 0.6 m^3. They are placed into the storage of contaminated oils in compliance with the Decree No. 86/99 Coll. on fire prevention. Plastic tanks of various sizes are used at SE-EMO to store oils and other contaminated dissolving agents. These are placed into MEVA drums with capacity of 200 l.

D.2.2 Technologies for treatment and conditioning of radioactive waste

Following technologies for radioactive waste treatment and conditioning are in operation:

- bituminization plants PS 44 and PS 100,
- purification station (obj.41),
- cementation line KWU,
- Bohunice Conditioning Centre (BCC RAW)
  - Incineration facility
  - Compaction facility
  - Concentration facility
  - Cementation facility into FRC containers.

Bituminization plants

The basic element of bituminization plant is a rotary film evaporator with a capacity of about 120 dm^3/h of vaporised water depending on the radio-chemical composition of treated concentrate. The main function of the evaporator is to evaporate the water from concentrated radioactive waste and to coat the crystals of dried salts with bitumen – fixing material. Both components (bitumen and concentrate) are dosed into the evaporator above the heating area in tangential direction. The final product is placed into 200 dm^3 drums. The drums are then closed and moved into temporal storage of radioactive waste. The emerged condensate is cleaned by an oil remover, vapex and carbon filter and pumped to the purification station of waste water for further cleaning (to reduce the level of radioactivity below limit values).

The bituminization plant PS 44 was commissioned in 1995.

In frame of the elementary system PS 44 – "Bituminization plant" a new technology was installed – "Non-continuous line" designed for treatment of radioactive sorbents and radioactive sludge. However, some deficiencies were revealed on the base equipment "calcinator" during the non-active tests. The non-continuous line was designed as modification to the equipment for radioactive sorbents. The purpose of proposed modification was to replace the original calcinator with centrifuge ALFA LAVAL in order to complete the drying of solid remainder by means of a drying equipment. The dry sorbents and sludge will be processed into a bitumen matrix by using the existing equipment or compacted by using a super compactor.

The bituminization plant PS 100 was commissioned in 2000. About 20 m^3 of radioactive concentrate from NPP V1 and V2 was treated on this plant during active tests. In years 2000 and 2001, the plant was used as a back up for the plant PS 44. At the end of year 2002, the plant was put back into full operation mode.

Purification station of radioactive water PS 100 in building No. 809

This station was originally designed for the treatment of low-level waste water produced by the bituminization plants PS 44 and PS 100. Currently, the connection of its tanks to the tanks of purification station in building No 41 is under construction. This will extend its utilisation for treatment of all low-contaminated water produced by facilities SE-VYZ facilities.

Water treatment on this purification station is realised by evaporation in an evaporator with natural circulation. The emerged condensate is cleaned by sorbent columns. Once the specific activity has been reduced below limit values the condensate is released into the environment in organised manner. After reaching optimal concentration the thick part is treated at the bituminization plants PS 100 or PS 44.

Purification station of radioactive water in building No. 41.

This purification station was designed to clean the contaminated water with total activity concentration less than or equal to $3{,}7.10^6$ Bq/dm^3 coming from the reactor building of NPP A1, building No. 809 and 28. After commissioning of BCC (building No. 808), it will receive water also from this facility. Water contaminated chemically and radio-chemically is cleaned by evaporation in boiler evaporator equipped with an external heater. The designed capacity of evaporator is 2.5 m^3/h of evaporated water, however the real capacity depends on the composition of treated water.

The resulted condensate is cleaned by ion exchangers until the specific activity of radionuclides in condensate drops below limit values. The condensate is then moved to the bituminization line to fix the salts by the bituminization matrix.

The purification station was commissioned along with the other technology in frame of NPP A1 commissioning and except of some outages due to modernisation it is in operation up to date.

Cementation line KWU

Cementation line KWU was installed in 1984 because the storage tanks of radioactive concentrate at NPP V1 were already full. It was designed for treatment of the radioactive concentrate produced during the operation of this NPP. The cementation line is a portable equipment. It produced 377 MEVA drums of cement product with capacity of 200 dm^3 each during the active tests and short-term operation. Because the line was not equipped with a concentration equipment the volume of final product was about twice of the input one. A gradual implementation of advanced fixation technologies of radioactive concentrates resulted in suspension of the non-economical operation of cementation line KWU. The line was kept as a back-up for an emergency situation producing large amount of liquid radioactive waste for the short period of time. After treatment of the radioactive concentrates by bituminization plant and cementation facility at BCC RAW a large volume of storage tanks at NPP V1 has been freed and the cementation line KWU is prepared for decommissioning. The cementation line was continuously blending the radioactive concentrates and cement and the created mixture was filled into drums. The cement was dosed by a turnstile dosing device into a spindle mixer. The radioactive concentrate from the storage tanks was directed into the mixer by means of a dosing pump. The homogeneous mash from the mixing equipment was directed via a four-way valve into one of the filling positions of 200 dm^3 drums. A conveyor was used to move the drums to the filling position.

Bohunice Conditioning Centre.

Bohunice Conditioning Centre is designed for treatment and conditioning of the radioactive waste, which can be classified into the following categories:

- combustible solid and liquid waste,
- compactable solid waste,
- non-combustible and non-compactable waste,
- concentrates,
- ion exchanging resins and ashes,
- other contaminated liquid and sludge.

The following technologies are used at Bohunice Conditioning Centre for the treatment and conditioning of radioactive wastes listed above:

- evaporator,
- cementation line,
- sorting facility,
- incinerator,
- equipment for storage and transport,
- super compactor.

Evaporator

Liquid and non-combustible radioactive waste from NPP A1, NPP V1 and VE V2 is accepted into the concentration equipment. When the concentration reaches the desired level, the waste is directed to the cementation line.

The evaporator itself is a flow-through type evaporator and consists of three U-shape sections. The capacity of evaporator is 500 dm^3/h at the concentration of dosed salts 200 to 300 g/l.

The final condensate is used to flush the equipment or it is utilised by the purification system of gaseous products of incinerator. In the end the condensate is directed to the purification station in building No. 41 or 809 and then released into the environment.

The final product – concentrate is gathered in the accumulator and then transported to the cementation line.

Cementation line

Radioactive waste enters the dosing tank of cementation line directly (concentrates) from the concentration device or via the inlet accumulators (resins – ion exchangers or sludge).

According to well tried methods the radioactive waste is dosed from dosing tank or ashes from dosing accumulator. The ingredients and cement are directed into an inclined mixer (500 dm^3).

After a thorough mixing the cement mixture is directed into a fibre-reinforced concrete container (3,1 m^3). Six batches from the inclined mixer are required to fill up the container. Containers with firm cement are closed, checked and shipped to the National Radwaste Repository at Mochovce. When the container is filled up with drums of bituminized product or compacted pieces of solid radioactive waste then three batches from the inclined mixer are needed to fill up the remaining free space in the container.

Sorting

Non-sorted solid radioactive waste is shipped to the sorting room or sorting box in the following form:

- free bulks in a foil,
- 200 dm^3 bags,
- 200 dm^3 drums

Once sorted, the radioactive waste is placed into 200 dm^3 drums and transported based on its classification as follows:

- non-combustible compactablewaste to the super compactor,
- non-combustible non-compactable to FRC containers for direct placement,
- combustible, wrapped in 15 l bags placed into 200 dm^3 drum to the tipping device of incinerator inlet box.

Incinerator

Incinerator is designed for combustion of the existing solid and liquid radioactive waste and radioactive waste to be produced in future in JE at Jaslovské Bohunice. Its capacity is 30 kg/h of solid waste when burning liquid waste at the same time or 50 kg/h of solid waste. The solid waste is dosed via a system of boxes into a feed box which represents a safety penetration – loop.

The incinerator's furnace is designed as a shaft-furnace with an inlet on the topside. No internal parts are built in. Combustion takes place in two areas. The lower area is designed for combustion of vapour-air mixture assuring temperature 900 °C, so neither cinder nor sinter is created on the walls. In the upper area the main amount of air is brought directly above the burning material (operation with oxygen surplus) and the air flow is set so that the temperature of combustion is about 800 to 1050 °C.

Gaseous combustion products from the furnace are directed to a combustion chamber where the burning process is completed at temperature 850 to 1100 °C.

Temperature in the lower section decreases to 850 °C due to injected water. The needed amount of reduction agent NOx-Out is dosed into this water in order to reduce the amount of NOx oxides in the gas outlet.

In the mixer the temperature of combustion products is reduced to 340 °C by injecting water and air. Because of the sudden temperature drop the range from 600 to 350 °C is quickly overrun so that the production of dioxins is significantly reduced. The gas outlets are cleaned by washers as well as by HEPA filters in order to remove radioactive particles with efficiency of 99.9 %.

The volume of ash produced by the incinerator is reduced by applying a crusher and then poured into 200 dm^3 drums. The ash in drums is transported to the cementation line as well as the cleaning water from the gas outlet washers. An alternative method is considered to be used for treatment of the produced ashes by compaction.

Equipment for storage and transport

This equipment is designed to handle the following objects between the individual storage places and facilities:

- fibre-reinforced concrete containers,
- 200 dm^3 drums, euro-palettes.

Super compactor

The super compactor is designed to compact the waste wrapped after sorting or shipped directly in 200 dm^3 drums. The drum is compacted by a force of 20 000 kN.

The compacted piece is moved step by step outwards on a take away sledge and finally placed into a concrete container. Free space inside the container is grouted with active cement mixture by using a cementation equipment.

D 2.3 IRAW management facilities

By Resolution No. 190/94 and 538/95 the Slovak government authorised SE-VYZ to perform activities related to management of IRAW and orphan sources (CRAM). That's why SE-VYZ completed its technical equipment and devices allowing to collect all types of IRAW and CRAM (radioactive waste produced by open sources, sealed sources and fissile material) from the territory of Slovak Republic. IRAW and CRAM with similar physical, chemical and radionuclide characteristics as RAW produced by nuclear power facilities are treated and conditioned together by using above waste management technologies and then disposed-of at National Radwaste Repository. Sealed sources that exceed the waste acceptance criteria for disposal in National Radwaste Repository and fissile materials are stored in certified storages at NPP A1.

D.2.4 Equipment for radioactive waste shipment

To ensure the concept of radioactive waste management in the Slovak Republic a transport system was implemented providing for shipment of:

a) solid and liquid radioactive waste on site of Jaslovské Bohunice
b) solid radioactive waste between Jaslovské Bohunice and Mochovce
c) institutional radioactive waste from the entire territory of Slovak Republic to Jaslovské Bohunice

Administration of radioactive waste shipment is assured by SE-EBO as a carrier and SE-VYZ as a consignor.

Shipment of radioactive waste is carried out in approved types of transport equipment and packagings by conveyances which meet the requirements of ADR regulations for class 7 and Decree No. 284/99 Coll. of ÚJD SR.

D.2.5 National Radwaste Repository

The National Radwaste Repository is a near surface facility designed for the disposal of solid and solidified low and intermediate-level radioactive waste produced by the operation of nuclear facilities and other institutions located on the territory of the Slovak Republic and engaged in activities producing radioactive waste. The site is located about 2 km west from NPP Mochovce.

The basic safety requirement on the National Radwaste Repository is that the release of radio-nuclides into the environment during its operation, period of institutional control and after closure must not result in radioactive exposure exceeding the limit values set by the valid regulations.

The National Radwaste Repository is situated into a geological formation with low permeability and high sorption capacity. Artificial clay layer represents an additional barrier against radioactivity leakage. A drainage system was installed into the space between the clay layer and disposal boxes. This drainage leads into monitoring shafts enabling to indicate water leakage from each disposal box independently. The concrete structure of repository, fibre-concrete container and solidified waste form create additional basic barriers against the leakage of radionuclides into the environment.

The National Radwaste Repository is protected against weather conditions by amobile coverage hall. This assures that the disposal area is covered during the whole period of disposal until it is replaced by final cap.

The National Radwaste Repository is created by a system of disposal boxes arranged into two double-rows with 40 boxes in each. Capacity of one box is 90 fibre-concrete containers. The total capacity of National Radwaste Repository is 7 200 containers with total volume of 22 320 m^3. The inside volume of fibre-concrete container is 3.1 m^3. The compacted and bituminised waste is fixed inside the container by means of an active cementation matrix.

ÚJD SR issued a permission for commissioning of the National Radwaste Repository in December 1999.

The capacity of the two double-rows (80 storage boxes) is 7200 fibre-reinforced concrete containers of radioactive waste (produced by operation and decommissioning and institutional waste) and will be sufficient for 10 to 15 years. Since the disposal of all the radioactive waste (meeting the acceptance criteria) requires to dispose about 35 thousand fibre-concrete containers, the National Radwaste Repository needs to be extended. The site layout enables to extend the capacity up to 10 double-rows.

D.2.6 Bituminization line and incinerator VÚJE

The bituminization line VÚJE was installed in 80-ties into a building originally designed for the special purposes of NPP A1. The layout of this building determined the location of bituminization line individual devices. This bituminization line was in operation for several years for research and experimental purposes especially to figure out the correct parameters for semi-operational bituminization of radioactive concentrates. The experience during the experimental operation of this equipment were used to design additional bituminization line (PS 44 and PS 100) at SE-VYZ and PS 48 at NPP Dukovany in the Czech Republic.

The bituminization line VÚJE was later modified into the present bituminization of two streams of radioactive waste. The second stream of radioactive waste is represented by dowtherm as contaminated cooling medium remained of spent fuel assemblies. Several experiments were carries out in 90-ties in order to optimise the process parameters and figure out the conditions to be recommended for the technology. In the first half of 1998, about 0.8 m^3 of dowtherm and 25 m^3 of concentrate was treated on this line. Since 1. 8. 1998 the bituminization line VÚJE is out of operation.

The experimental incinerator for combustion of soft combustible radioactive waste was installed by VÚJE in co-operation with other organisations in 1985. Research and experimental activity in years 1986 to 1989 focused on optimisation of combustion. The results of experiments served as input data for the design and construction of a new furnace and equipment for purification of combustion products. Operating procedures for the combustion of radioactive waste were prepared based on the experience. Experiments resulted in optimisation of operating parameters of combustion with the aim to achieve the best possible quality of final product while keeping high reduction factors (100 for volume, 16 for mass), high efficiency of gas filtration (HEPA filter with efficiency of 99.995%) with minimum impact on environment and exposure of personnel to radiation.
Some modifications to the incineration technology of contaminated oils were made (installation of third burner, installation of a tank for contaminated oil and installation of diesel oil tanks with pressure air and pipes) in years 1989 to 1990.

About 440 l of contaminated oil from NPP A1 was incinerated during the tests. Based on the test results the manufacturer suggested to replace the present two-chamber grate furnace with a cylindrical one equipped with ceramic retaining bath for the incineration of liquid radioactive waste. Because this furnace has not been arranged yet, about 12 to 20 t/year of soft radioactive waste from NPP A1, V1 and V2 were treated by the incinerator SP 602 during the years 1992 to 2000.

Since 2001 the incinerator at BCC is in operation and the experimental incinerator VÚJE is used quarterly to incinerate the soft radioactive waste produced by VÚJE laboratories.

The incinerator includes a simple experimental cementation equipment originally designed for the cementation of ash produced by the experimental incinerator and filled into drums with capacity of 200 l. Nowadays, this equipment is used only for experimental cementation of sludge and gravel and for pre-treatment of the ash before applying super compaction.

D.3. List and description of facilities under decommissioning and equipment for decommissioning radioactive waste management

D.3.1 NPP A1 Bohunice – under decommissioning

NPP A1 with a heterogeneous reactor KS-150 was designed to generate 143 MW electric power. It utilised natural metal uranium as fuel, heavy water (D_2O) as a moderator and carbon dioxide (CO_2) as a coolant.
The moderator was cooled by three loops. Each loop consisted of two coolers and one heavy water pump. The primary cooling circuit (CO_2) comprised 6 loops, while each loop consisted of one steam generator, one turbo-compressor and hot and cold legs. NPP A1 had equipment for completion of fuel assemblies and transportation equipment (TE) designed to manipulate with fresh and spent fuel and to assure its cooling and storage. The cooling and storage system of spent fuel included two short-term storages and a long-term storage – spent fuel pond. The spent fuel was moved using a refuelling machine into the casks with coolant placed in spent fuel pond. Chrompik (water solution of potassium bichromate) was used initially as a coolant. Later it was replaced by an organic coolant dowtherm (mixture of biphenyl and biphenyloxid). Three turbo-generators with installed power 50 MW each represented the main equipment of secondary circuit.
NPP A1 was commissioned in December 1972. After an accident (INES level 4) in February 1977 the operation of NPP A1 was interrupted. There were performed technical, economical and safety analyses and based on the results of these analyses the government within his Resolution No. 135/79 decided about NPP A1 decommissioning.
There started activities heading toward the decommissioning of NPP A1. Because of absence of legislation related to the decommissioning of nuclear power plants the partial problems were solved case-by-case and the individual steps were approved as modifications effecting the nuclear safety. Activities were mainly focused on:

- minimization of operating event consequences ,
- preparation oftransfer of spent fuel to the former Soviet Union/Russian Federation,
- development and installation of radioactive waste management technologies.

First complete documentation on decommissioning of NPP A1 was elaborated in 1992. The government Resolution No. 227/92 established a valid concept and schedule of NPP A1 decommissioning. The additional government Resolutions No. 266/93, 524/93, 877/94 and 649/95 approved this schedule including the related complex procedure.
Updated documentation for the initial phase of decommissioning was prepared in years 1994 to 1996. After the approval of safety report prepared in 1996 and after completion of spent fuel transfer to the Russian Federation, ÚJD SR issued in 1999 the permition for the first phase of decommissioning based on the Atomic Act No. 130/1998.

- The first phase of NPP A1 decommissioning that should finish in 2007 can be characterised as follows:
- All spent fuel has been removed from the long-term storage and the liquid waste that represents the highest potential risk has been solidified or stored in new tanks.
- The majority of liquid operational waste has been conditioned into a form enabling safe disposal,
- The other radioactive waste has been processed into a form allowing safe disposal or storage,
- The essential decontamination has been completed aiming to reduce the potential sources of radioactivity leakages,

The present status of NPP A1 can be characterised as follows:

- Transport of spent fuel into the Russian Federation was completed in 1999 (based on an international contract from 1956|
- Liquid waste resulting from spent fuel cooling were partially processed and partially placed to new tanks: chrompik was vitrified and sludge was partially solidified into geo-polymers, dowtherm is gradually incinerated. More than 99% of radioactivity from the long-term storage pool water was absorbed by special sorbents. The sludge from the bottom of long-term storage pool will be solidified in frame of the first decommissioning phase.
- Liquid operational waste (concentrates) was bituminized and now it is continuously disposed.
- The original tanks in building No. 41 containing contaminated sludge and the storage of solid radioactive waste in building No. 44/20 represent the highest potential risk for the environment. The waste is continuously processed

Equipment with induced radioactivity or higher level of contamination will be dismantled in the next decommissioning phase.

D.3.2 Equipments for management of decommissioning radioactive waste placed in NPP A1

Reconstructed building No. 44/20 – hall above original shaft including sorting equipment

This equipment was designed to prepare the radioactive waste, initially stored in shafts for treatment by BCC RAW or fragmentation. The various solid radioactive waste produced during the operation of NPP A1 were poured in underground concrete boxes. In 80-ties flooding occurred and consequently, the organic waste highly biodegraded.
The radioactive waste on the working table of sorting equipment is sorted into waste categories: combustible, compactible, metal and other and placed into 200 dm^3 MEVA drums. Before storing, the combustible waste is wrapped into plastic bags of specified mass or weight. The sorting area is cleaned by a high-performance ventilation system. The radioactive waste is moved from the shafts to the working table by means of a polyp grab connected to the suspender of a crane with a capacity of 20t.
The emptied shafts are decontaminated, dried, isolated from the environment and after inner wall treatment they are used for storage of solid waste before its conditioning at BCC. More then half of original waste has been removed.

Fragmentation facility

Fragmentation is situated to the NPP A1 turbine hall. Sorting and fragmentation and sorting of metal radioactive waste with surface contamination up to 500 Bq/cm^2 begin in 1996. Metal waste resulting from dismantling of NPP A1turbine hall and from refurbishment of NPP V1 was processed. To allow fragmentation ofmetal materials with higher contamination, upgrading of facility started in 2000. The refurbishment of essential systems finished in 2002. New thermal cutting including ventilation system with regeneration filter was installed. A cross and lengthwise saw was installed to cut the contaminated pipes with a diameter up to 500 mm. A new working place was created for dry decontamination of metal radioactive waste by sandblasting. In addition to the fragmentation also a decontamination is planned to be performed by applying sandblasting. After performing monitoring by a certified monitoring system a certificate is issued and portion of the materials can be released into the environment.

High-capacity decontamination equipment

The high-capacity decontamination electrochemical, chemical and ultrasonic tanks are placed in turbine hall and connected with ventilation system. It comprises chemical management system for the preparation of fresh decontamination solutions and for neutralization of used solutions.

Decontamination of metal radioactive waste started in 1999.

In 2002 the high-capacity decontamination was completed by a chemical decontamination enabling to decontaminate the stainless steel as well as carbon steel materials. At the same time the inlet lines (steam, demineralised water and high-pressure air) were re-constructed. To enhance the efficiency of decontamination, the pump and lines cross-connecting the individual decontamination tanks were re-constructed as well.

ÚJD SR by his decision authorised SE-VYZ to operate the high-capacity decontamination equipment for the metal scrap with surface contamination up to 3000 Bq/cm^2.

It is assumed that the majority of decontaminated metal materials could be released into the environment after permittion will be issued.

Vitrification facility (VICHR)

The vitrification is used for solidification of the radioactive chrompik into a glass matrix of boric-silicate type with the aim to achieve significant reduction of volume and highly enhance the safety while storing this specific radioactive waste. Chrompik is pumped from the storage tanks into a measuring tank with a capacity of 128 dm^3 in order to be dosed into an evaporator. Here the chrompik, at temperature 143 °C, is processed into 3 dm^3 of concentrate, which is then moved into an inductive furnace. After adding a glass matrix the concentrate is dried and the mixture is melt down. The resulted mixture is poured into containers and moved into an interim storage. During the drying process the residual moisture is directed into a condenser and moisture separator. The condensate is returned back into the vitrification inlet line. Radioactivity of vapour coming from the evaporator is reduced by applying sorbents. Several parts of the vitrification facility are cooled by a cooling system, which creates also a barrier against release of radioactive materials in case of leakages.

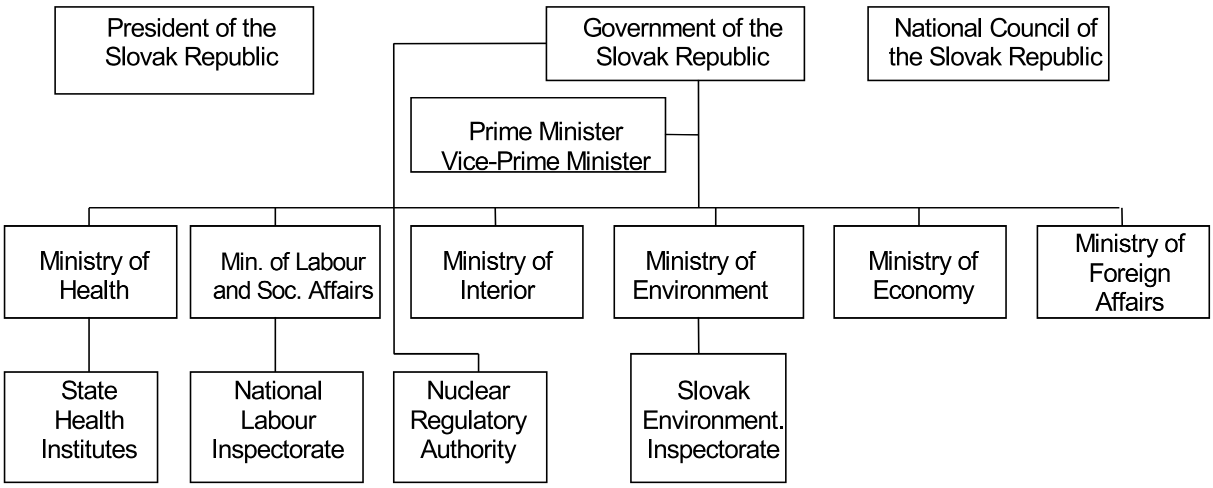
E. Legislation and Regulation

E.1. Legislative and regulatory system

E.1.1 Structure of regulatory bodies

Regulation concerning the peaceful use of nuclear energy is performed pursuant to Act No. 130/1998 Coll. on Peaceful Use of Nuclear Energy and on amendment to Act No. 174/1968 Coll. on State Regulation of Safety at Work as amended by Act of National Council of the Slovak Republic No. 256/1994 Coll. as amended by Act No. 470/2000 Coll. by the governmental bodies and organisations within the framework of their competence defined by the respective acts according to the structure described bellow:

Structure of Regulatory Authorities



Nuclear Regulatory Authority of the Slovak republic

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 (MoI)

Ministry of Interior is a central state administration authority responsible *inter alia* for the conceptual management and control of fire protection, integrated rescue system (Act No. 129/2002 Coll. on Integrated Rescue System), including the civil protection of population and property, public order and safety of persons. The Ministry is also responsible for the organization of aid to population (Act

No. 42/1994 Coll. on Civil Protection as amended by later regulations) in case of nuclear and radiation accident.

Ministry of Economy of the Slovak Republic (MoEc)
Ministry of Economy of the Slovak Republic is a central state administration authority responsible for (*inter alia*) nuclear energy, including the management of nuclear fuel and storage and disposal of radioactive waste, authorisation of import and export of special materials and equipment.

Ministry of Labour, Social Affairs and Family of the Slovak Republic (MoL)
Ministry of Labour, Social Affairs and Family of the Slovak Republic is a central state administration authority responsible *inter alia* for the safety and health at work and labour inspection. State administration in the area of inspection is executed by the MoL, National Labour Inspectorate and Labour Inspectorates.
National Labour Inspectorate reports to the MoL and executes *inter alia* the labour inspection in the field of nuclear energy and regulation pursuant to separate regulations. Labour Inspection consists mainly of regulation relating to the compliance with legal norms and other regulations concerning the safety and health at work and safety of technical equipment. Regulation is executed pursuant to regulations mentioned in part F.5.3.
Technical Inspection reports to the MoL and verifies the compliance with the requirements relating to safety of technical equipment.

E.1.2 Legislation

E.1.2.1 Introduction
The Legal system is structured as follows:
1. Constitution is the supreme basic law of state and is adopted by the Parliament – Constitution is generally binding.
2. Constitutional acts.Laws defining basic rights and obligations specifying the principles in various areas; they are adopted by the Parliament and are generally binding.
3. Approximation ordinances issued by the Government.
4. Governmental ordinances are subordinated to laws and are adopted by the Government – they are generally binding.
5. Central state administration authorities (e.g. ministries) issue (regulations) decrees and orders and measures to define details of laws' and governmental ordinances' implementation – they are generally binding.
6. Guides (handbooks) contain detailed requirements and recommended steps to secure compliance with the requirements. They are issued by the regulatory authorities (not mandatory).
7. Internal standards (such as e.g. directives and instructions) represent the internal organizational rules issued by the respective regulatory authority; they are considered the base of the internal quality assurance system.

E.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. 575/2001 Coll. on Organisation of Governmental Activities and on Central State Administration as amended by later regulations defines the framework of tasks and competence of ministries and central state administration authorities.
Being one of the basic laws, **Energy Act No. 70/1998 Coll.** as amended by later regulations regulates the conditions of business activities in the nuclear energy sector in the Slovak Republic as well as the rights and obligations of natural persons and legal entities doing business in this area.
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. on the Protection of Public Health as amended by later regulations and the implementing Decree issued by the Ministry of Health of the Slovak Republic No. 12/2001 Coll. on the Requirements for Radiation Protection defines the general requirements for the health protection, state authorities responsible for health protection, their competence, obligations of persons when securing the health protection, requirements for the execution of state regulation and sanctions. Chapter on radiation protection establishes the basic principles of radiation protection conditions and requirements for granting permits of activities leading to irradiation and of activities important from view of radiation protection and requirements for management of radiation sources and institutional radioactive wastes, responsibilities of license holders, conditions for releasing radioactive materials into the environment, requirements for radiation protection of workers and public including the irradiation limits, requirements for radiation protection optimisation, requirements for the radiation protection in case of incident and accident.

Act No. 50/1976 Coll. on Territorial Planning and Construction Order (so-called Construction Act) as amended by later regulations, defines the obligation of the Construction Authority to obtain, prior to the issuance of location permit, building permit and commissioning decision concerning the constructions with the nuclear facility, standpoint of ÚJD SR. ÚJD SR is authorised to condition the issuance of its approval by the fulfilment of specific conditions.

Act No. 95/2000 Coll. on Labour Inspection as amended by Act No. 231/2000 Coll. regulating inter alia the about inspection, defines the labour inspection related competence, rights and obligations of legal entities and physical persons including the issuance and disqualification of permits and certificates authorizing the acitivities on nuclear facilities.

E.1.2.3 Nuclear safety related state regulation executed by ÚJD SR

Act No. 130/1998 Coll. is considered the basic piece of legislation, on the basis of which decrees are being drafted and ÚJD SR decisions are being issued. Up to this moment, certain regulations adopted during the former Czechoslovakia are still applicable.

ÚJD SR issues different types of decisions, including permits, licences, approvals and consents. The following types of decisions are concerned:

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

b) **it grants and withdraws permits to**

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

d) **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. tart individual stages of commissioning of nuclear installations,
   4. operate nuclear facilities,
   5. extend the operation of nuclear installations;

e) **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;

f) 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;

g) verifies the professional qualification of selected employees.

Acquisition and use of nuclear materials

- Nuclear materials may only be acquired and used on the bases of permit issued by ÚJD SR.
- ÚJD SR may grant permits for a longer time period not exceeding ten years.

Shipment of nuclear materials and radioactive waste

- Nuclear materials and radioactive waste may only be shipped on the basis of shipment permit issued for the carrier or consignor by ÚJD SR.
- Nuclear materials and radioactive waste may only be shipped in the transport equipment, type of which has been approved by ÚJD SR.

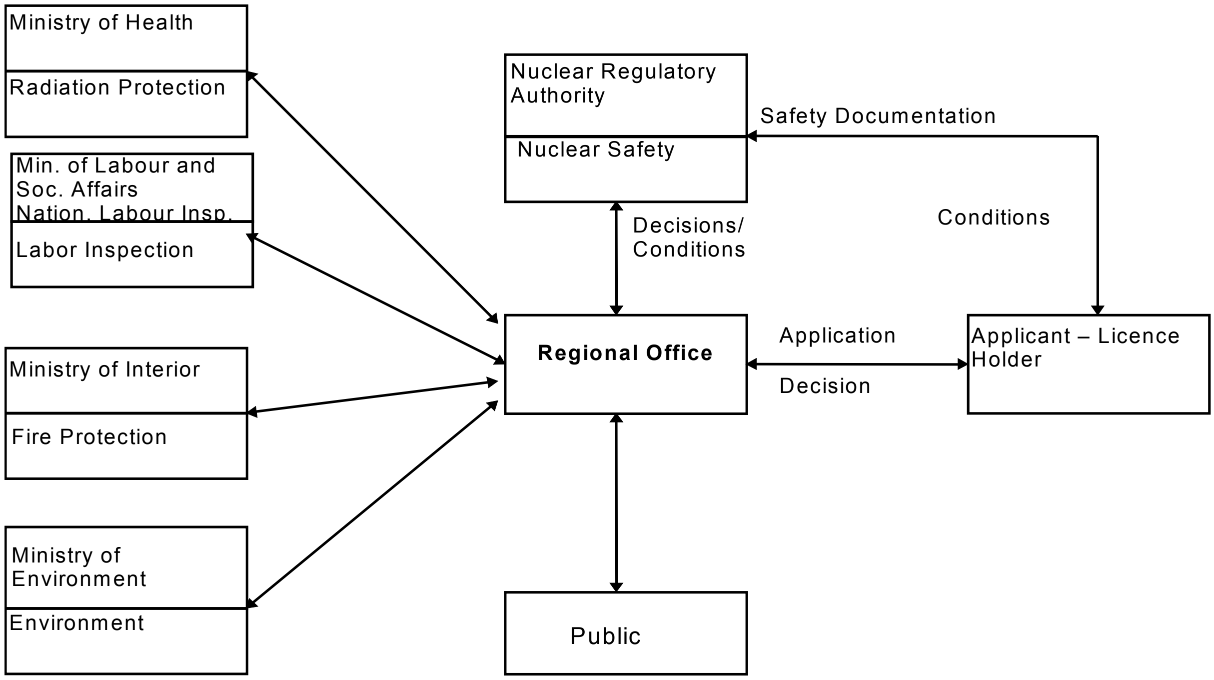
Approval of nuclear facility construction shall be issued by ÚJD SR on the basis of a written application submitted by the constructor accompanied with the respective safety documentation (see chapter H.4).
Approval of nuclear facility commissioning shall be issued by ÚJD SR on the basis of an application submitted by the operator accompanied with the respective safety documentation (see chapter H.6).
Approval of nuclear facility operation shall be issued by ÚJD SR on the basis of an application submitted by the operator accompanied with the report on evaluation of the respective stage of nuclear facility commissioning (see chapter H.6). The nuclear facility operator including facilities for SF and RAW management is forbidden without approval of ÚJD SR.
Extension of nuclear facility's period of operation
ÚJD SR may extend the validity of approval for the nuclear facility's operation on the basis of actual condition of facility and on the basis of additional safety documentation.
Radioactive waste management
A license holder is authorized to manage the radioactive waste exclusively on the basis of ÚJD SR permit.
Changes during nuclear facility's construction, operation and decommissioning having the impact on the nuclear safety must be submitted by the constructor or operator to ÚJD SR for its approval.
Quality assurance
Quality systems and requirements on quality of nuclear facilities and activities shall be subject to ÚJD SR approval and monitoring.

E.1.2.4 Proceedings for the licensing of nuclear installations

Norms and recommendations issued by the International Atomic Energy Agency are being used in the licence procedure.

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 E.1.2.4 illustrates the major regulatory bodies and the procedure for the licensing of standing operation.

Picture. E.1.2.4 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. and Decree of SÚBP No. 66/1989 Coll. as amended by Decree No. 31/1991 Coll. and Decree issued by the Ministry of Labour, Social Affairs and Family of the Slovak Republic No. 718/2002 Coll.
License holder bears liability for the safety and nuclear facility.

E.1.2.5 Radiation protection related requirements and regulations (see E.2.)

E.2. Regulatory authorities

E.2.1 Nuclear safety regulation

ÚJD SR, being a successor to the former ČSKAE, was established on 1 January 1993. ÚJD SR competence is defined by Act of the National Council of the Slovak Republic No. 2/1993 Coll. ÚJD SR is an independent state regulatory authority reporting directly to the Government, headed by the ÚJD SR Chairman appointed by the Government. Independence of the regulatory authority from any other body or agency dealing with the development or utilization of nuclear energy is applied in all relevant areas (legislation, human and financial resources, technical support, international co-operation, enforcement tools).
Pursuant to Act No. 130/1998 Coll. ÚJD SR is authorised to issue generally binding legal norms – decrees. ÚJD SR budget is part of the State Budget. Financial and human resources are at the disposal of ÚJD SR used for the independent safety analyses and technical support. 82 employees were employed by ÚJD SR as of 1 January 2003.
Internal quality system are being developed since 1999 pursuant to IACE-TECDOC-1090 and ISO standard 9001:2001, with the aim to achieve a high quality of ÚJD SR tasks fulfilment arising from ÚJD SR mission. ÚJD SR Quality Handbook in line with the requirements stated by ISO norm 9001:2001 has been in force since January 2002 defining the basic procedures included in the quality system, for which the respective directives were developed in 2002.

E.2.1.1 Role of regulatory authority

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.

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 E.2.2.3),
- 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,
- 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.

E 2.1.2 Regulatory methods to verify operator's compliance with licence conditions 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:

<u>Routine inspections</u> 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.

Fine
Pursuant to the approval authorizing the operation and radioactive waste management, the requirements and conditions of nuclear safety approved and introduced by the regulatory authority are monitored. In case of failure to fulfil nuclear safety, the regulatory authority is authorized to impose penalty on the licence holder, as well as on its employees. In case of failure to fulfil the requirements or legal provisions, the regulator is authorized to impose on the licence holder a sanction including the financial penalty.

E.2.2 State regulation relating to health protection against radiation
State health regulator in nuclear facilities is responsible for the radiation protection inspection of the nuclear facility's employees and of population in the vicinity of the respective nuclear facility. Principal requirements with respect to health protection against radiation are defined by legal regulations mentioned in Section E.2.2.2.
Regulation of nuclear safety when defining safety requirements on technological equipment and operation of nuclear facilities is to the end-effect based on the requirements related to health protection and vice versa. Accordingly, the co-operation of ÚJD SR and the Slovak Ministry of Health is of importance, as well as their complementary functioning. ÚJD SR and the Slovak Ministry of Health entered into the agreement on co-ordination of regulatory activities and providing for their common complementary regulation. A joint committee on the issues of common interest has been established by the agreement.

E.2.2.1 Approval procedure
Approval of the activities resulting in irradiation is subject to provisions of Act No. 71/1967 Coll. on Administrative Proceeding. Act No. 272/1994 Coll. on Protection of Public Health as amended by later regulations defines in detail the conditions for granting permits, in particular:
- the requirements on applicant for permit,
- the requirements on expert representative for the radiation protection,

- the requirements on contents of application for permit,
- the list of documents to be approved and other documents.

The Act further defines the requirements for permit and conditions under which permit may be changed, revoked or under which it loses its validity.

The mandatory documentation to be attached to the application for permit authorizing the activities resulting in irradiation could be classified as documentation subject to approval and other documentation. Documentation subject to approval includes:

- the radiation protection quality assurance,
- the radiation protection programme,
- the proposal for inspected zone definition,
- the workplace monitoring plan,
- the emergency plan.

Other documentation includes a list of background documents and documents used by the applicant to provide the evidence of compliance with the requirements concerning radiation protection and safe operation of nuclear facility.

E.2.2.2 Regulatory authority for radiation protection

Regulation of health protection against radiation in the Slovak Republic is provided by the State Faculty Health Institute pursuant to provisions defined by Act No. 272/1994 Coll. on Public Health Protection, as amended by later regulations. Authorities of the state health regulation for protection against radiation include the Chief Hygienist of the Slovak Republic and the corresponding State Regional Hygienist. With respect to health regulation in nuclear facilities, the responsible body is the Chief Hygienist of the Slovak Republic.

E.2.2.3 Regulatory authority competence

State health regulator in nuclear facilities is responsible for the radiation protection inspection of the nuclear facility's employees and of population in the vicinity of the respective nuclear facility. Regulation of nuclear safety when defining safety requirements on technological equipment and operation of nuclear facilities is to the end-effect based on the requirements related to health protection and vice versa. Accordingly, the co-operation of ÚJD SR and the Slovak Ministry of Health is of importance, as well as their complementary functioning. Last barrier that shall provide for the nuclear facility safety and prevent the leak of ionizing radiation or radioactive substances into the working or natural environment is considered a borderline dividing the regulatory competence over the nuclear safety and nuclear protection.

ÚJD SR and the Ministry of Health of the Slovak Republic entered into the agreement on co-ordination of regulatory activities and providing for their common complementary regulation. In terms of the provisions of the above mentioned Act, the Chief Hygienist, with respect to nuclear facilities:

- grants permits for:
  - the commissioning of nuclear reactors – physical commissioning,
  - the permanent operation of nuclear reactor,
  - the performance of maintenance and repairs on nuclear reactors,
  - the constructional and technological changes,
  - the shipment of radioactive sources,
  - the cancellation of workplaces with nuclear reactor (final removal of radiation sources and of radioactive contamination),
  - the discharge of radioactive substances into the environment, while setting limits for radioactive emissions and liquid discharges,
- approves reserved documentation and inspected zones,
- issues opinions on:
  - the construction and constructional and technological changes during construction relevant from the aspect of radiation protection,
  - the individual steps of commissioning,
  - the individual stages of decommissioning and on structural and technological changes during decommissioning relevant from the aspect of radiation protection,
  - the territorial planning documentation in connection with the location of nuclear reactor,
  - the proposal of hygienic protection zones definition,
- issues instructions for elimination of identified shortcomings,
- establishes commissions to review the expert competence on activities resulting in irradiation,
- imposes sanctions.

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

- for personal dosimetry,
- for monitoring of working conditions and environment,

- for the performance of expert training concerning the performance of activities.

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

E.2.2.4 Regulation method to verify fulfilment of licence conditions

Regulation of radiation protection in the nuclear facilities is performed by Nuclear Installations Department of Division for Health Protection Against Irradiation at the State Health Institute of the Slovak Republic. This Department is responsible for inspection of radiation protection of nuclear facility's employees and also for the inspection of radiation protection of population in the vicinity of nuclear facility. The above-mentioned Act defines the responsibilities of licence holders to provide information and enable the exercise of state regulatory activities and defines also the authorisations of persons exercising the regulatory activities.

Approval of the activities resulting in irradiation is subject to provisions of Act No. 71/1967 Coll. on Administrative Proceeding. Act No. 272/1994 Coll. on Protection of Public Health as amended by later regulations defines in detail the conditions for granting permits, in particular:

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

The Act further defines the requirements for permit and conditions under which permit may be changed, revoked or under which it loses its validity.

The mandatory documentation to be attached to the application for permit authorizing the activities resulting in irradiation could be classified as documentation subject to approval and other documentation. Documentation subject to approval includes:

- the radiation protection quality assurance,
- the radiation protection programme,
- the proposal for restricted zone definition,
- the workplace monitoring plan,
- the emergency plan.

Other documentation includes a list of background documents and documents used by the applicant to provide the evidence of compliance with the requirements concerning radiation protection and safe operation of nuclear facility.

Persons exercising the state regulatory activities in the area of health are in terms of provisions defined by the respective legal norms authorized to enter the enterprises and premises, request information, take samples, investigate and inspect the corresponding documents. When exercising their activities, they verify the compliance with the generally binding legal act and regulations, conditions set in permits, measures and instructions issued by the regulatory authority for health protection.

Inspection of radiation protection is provided by:

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

According to the purpose of inspections they usually include monitoring of radiation situation in the working environment, in the vicinity of nuclear facilities and in the reference localities, using their own means. The objective of measurement is to evaluate the objectification of the nuclear facility operation impact on the working conditions and environment.

When exercising the state regulatory activity with respect to radiation protection, persons exercising the activities inspect mainly:

- the radiation situation in the nuclear facility, while performing their own measurements,
- the compliance with approved documentation,
- the dose-related burden on employees, records of dose exposure of nuclear facility's employees, with their own analyses of burden on employees,
- the monitoring of discharges, with random inspection measurements of some parameters of the radioactivity discharges,
- the application of optimisation of radiation protection,
- the expert and health-related capacity of employees, managers and expert representatives for radiation protection,
- the documentation relevant for the health protection against radiation,
- the conditions for discharge of radioactive substances into the environment,
- the preparedness of nuclear facilities for radiation incidents and emergency situations,

- the impact of nuclear facilities operation on the radioactivity of environmental items and exposure of population to doses, with performing their own analyses concerning the radioactivity of environmental items,
- the activities of radiation inspection laboratories in the vicinity, etc.

Employees exercising the regulatory activity prepare on the basis of findings, background documents for decisions of the health protection authority when executing the approval activities resulting in irradiation and in imposing measures, instructions or sanctions.

Nuclear Installations Department performs mainly the monitoring of dose rates, activities of airborne particles, surface contamination or other special measurements in the working environment. In the nuclear facility's vicinity, the monitoring of integral doses using TLD method and discontinuous measurements of dose rates is used in the monitoring point 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 vicinity of nuclear facility. At irregular intervals, parallel analyses of airborne particles in exhalations and samples of wastewaters are performed by the Department.

E.2.3 National Labour Inspectorate (NLI)

Act No. 95/2000 Coll. on Labour Inspection as amended by later regulations became effective on 1 July 2000. The Office for Labour Safety (herein referred to as ÚBP SR) was cancelled and pursuant to § 5 sec. 3 letter f) NLI carries out labour inspections in the nuclear energy sector.

According to the above mentioned Act the labour inspection in the nuclear energy sector is carried out in order to supervise the compliance with the legal and other provisions relating to the protection of safety and health at work and to the provision of technical equipment safety including regulations governing the environmental factors.

With respect to the labour inspection the National Labour Inspectorate:

- issues permits to the legal entities granting them the right to issue certificates on the safety of technical devices and disqualifies these licences,
- proposes what technical equipment shall be considered the reserved technical equipment,
- proposes the conditions and method of evidence and registration of injuries at work, operational accidents (incidents) and failures of technical equipment including the direct investigation of these events,
- applies the labour protection requirements on granting of building permit and commissioning decision,
- decides on imposing the penalty provided that the execution of labour inspection in the nuclear energy sector is concerned,
- issues permits and certificates to legal entities and persons authorizing to execute the activities on nuclear facilities and examines the compliance with the scope of permits and certificates and with other conditions of their issuance, and disqualifies these permits and certificates from legal entities and persons.

F. Other General Safety Provisions

F.1. Responsibility of the licence holder

F.1.1 Principles and definition of nuclear and radiation safety

Nuclear safety is according to the Act No. 130/1998 Coll. state and ability of nuclear facility and its operational staff to prevent uncontrolled fission or unauthorized release of radioactive materials or ionising radiation to the environment and to minimize consequences of accidents and emergencies.
Operator is responsible for nuclear safety. Operator ensures all aspects of nuclear safety, mainly:

- sufficient financial and human resources,
- skilled employees,
- complex and systematic assessment of nuclear safety including measures for elimination of failures,
- measures and procedures, which will create assumptions for verification, improvement and minimization of consequences of accidents and emergencies,
- physical protection of nuclear facilities and nuclear materials,
- coverage of own responsibility for nuclear damages by insurance or other type of financial assurance.

Operator determines responsibilities and competences of individual departments in order to achieve effective management and safety operation of nuclear facilities in compliance with safety requirements. ALARA principle (As Low As Reasonably Achievable - the lowest rationally achievable level) is established. Operator issues procedures for all activities. If occurred such situation, that for some activities are not established procedures, it is possible to establish program, which should be approved by the process determined by ÚJD SR. That can be temporary solution, which will be consequently adapted in the procedures.

The operator is obliged to report to ÚJD SR events on nuclear facilities and in case of accidents and emergencies also to further organizations and to the public, and adopt measures to prevent their repetition.

Operator provides public information about nuclear safety including its own independent assessment.

Operator of nuclear facility uses further specialized supporting organizations in the area of maintenance, operation or research.

IAEA recommendations are incorporated into internal documentation of regulatory body and operator. The operator's highest level are strategies for individual areas, including nuclear and radiation safety strategies, where priority of nuclear safety is declared. In the operating documentation of the quality system for nuclear safety, radiation safety and emergency planning are applied IAEA safety standards and safety principles (INSAG 3, INSAG 4, INSAG 10, INSAG 12, INSAG 13 and INSAG 15.) Safety standards and guides of IAEA create base for elaboration of working documentation of the quality system, as well as operating documentation of the operator.

Technical equipment safety is technical safety, which is characterized by physical state of individual equipment, which ensure its strength, tightness, reliability and functionality in the scope of designed operational states for their whole lifetime. Record keeping and technical-organizational measures directed to the reliability of operation without jeopardy for people or property are very important part of technical safety.

F.1.2 Conception of nuclear and radiation safety

The Board for Directors of Slovenské elektrárne, joint-stock company, accepted on its meeting on November 1997 Nuclear and Radiation Safety Strategy as follows:

1. Slovenské elektrárne, joint-stock company produces electric power and heat also from nuclear fuel.

2. Board of Directors of Slovenské elektrárne is responsible for nuclear and radiation safety. and assures public, that has permanently under control all activities related to nuclear power plants, from the siting to design, construction, commissioning, operation, decommissioning, all including spent fuel management and radioactive waste management.

3. Obligations resulting from the basic responsibility are delegated on concrete senior executives from the management of the company and branches, which ensure management of nuclear power facilities.
4. Main principles of observance of nuclear and radiation safety:
   - nuclear safety is prior all other interests of the company,
   - increase of nuclear safety according to latest information with aim to maintain European standard and standards of International Atomic Energy Agency is a permanent and systematic process,
   - in all activities related to nuclear power plants the safety culture principle is applied as well as principles of multilevel, overlap each other protections, so called protection to depth. The priority is the attention to integrity of barriers against release of radioactive matters to the environment,
   - individual exposure limits and limits of discharges determined by the legal basis of the Slovak Republic and by decisions issued by regulatory bodies, must not be violated and real exposure and discharges should be as low, as it is achievable by reasonable way.
   - for fulfilment of responsibility for nuclear and radiation safety are created organizational conditions by establishing of:
     - independent department of nuclear and radiation safety,
     - committee of nuclear safety as advisory body of Board for Directors for assessment and solution of complex problems of nuclear safety,
   - Quality System of Slovenské elektrárne is build-up in accordance with the requirements of regulatory bodies and legal basis of the Slovak Republic, recommendations of the International Atomic Energy Agency and the requirements of the standards STN EN (ISO 9000),
   - Available knowledge and experiences from all nuclear power facilities from the Slovak Republic as well as from abroad are permanently used,
   - open dialog with the public is exercised as well as with local and regional bodies of state administration.

5. The company spends necessary resources on fulfilment of main principles of nuclear and radiation safety and ensures permanent increase of education and qualification of employees.

6. Nuclear and radiation safety strategy is obligatory for all employees of Head quarters of the Slovenské elektrárne and its branches which operate nuclear power plants

7. Director of the Department of Nuclear and Radiation Safety is responsible for development of this strategy and for determination and inspection of criteria for nuclear and radiation safety assessment.

F.1.3 Obligations of operators to regulatory authority

Nuclear power can be used only for peaceful purposes and in compliance with international obligations. Such level of nuclear safety, occupational safety and health protection against ionising radiation should be achieved, that risk of jeopardy of life and health will be lower than that determined by the legal basis (the Act of NR SR No. 272/1994 Coll.) and according to available knowledge as low, as it is possible reasonably achieve.

Obligations of operator are given, first of all, by Atomic Act No. 130/1998 Coll. in the areas:

- siting and construction of nuclear facilities (§ 14)
- operation of nuclear facilities (§ 15, § 16, § 20, § 22, § 23, § 24)
- RAW management and spent fuel management (§ 17, § 18)
- decommissioning of facilities (§ 19)
- financial and human resources (§ 20, § 21)
- information of the public and the regulatory body (§ 20)
- emergency planning (§ 25)
- liability (§ 26, § 27, § 28, § 30)

ÚJD SR determined in its decisions in accordance with Act No. 130/1998 Coll. the scope, periodicity and terms of regular reports submitted by Slovenské elektrárne. Reports are issued two times per year (basic characteristics of RAW and RAW flows) or annually which contain this basic information:

- report on radiation safety and environment impact assessment
- basic characteristics of RAW and RAW flows
- report on the state of nuclear safety and reliability

Verification and assessment

Holder of operational license of nuclear facility is obligated to provide Radiation protection regulatory body particularly this information:

Urgently:
- radiation event, accident and emergency,
- overload of exposure limit of employees,
- overload of discharge limit.

In scheduled terms:
- information about operation,
- individual doses of employees and contracted employees in individual periods of monitoring,
- analyses of doses during shut down period,
- annual evaluation of individual and collective doses for employees and contracted employees,
- quarterly and annually- balance of radioactive discharges to the environment,
- annual report on results of environment monitoring, annual report on results of model environmental impact assessment based on influence of discharges.

F.2. Human and financial resources

F.2.1 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.

Operator is responsible for overall working (technical, health and mental) qualification of its employees to perform working activities in nuclear facilities. Operator charges by execution of working activities only competent employees. For each selected and competent employee is issued “Assignment for Execution“ for relevant working activities as a part of quality assurance of nuclear facility. Assignment for Execution of working activities is issued on job positions of selected employees with valid Certificate on Professional Capability on the given type of nuclear facility and on job positions of selected employees with valid Testification on Professional Capability on the given type of nuclear facility. Assignment is the evidence of working qualification of employee in relation to the regulatory bodies.

In the organizational structure has each job position defined requirements on working qualification for the execution of the job position, that is, education, technical, health and eventually mental qualification and specified types of preparation. Direct boss of employee is responsible for fulfilment of these requirements.

Preparation - acquisition, maintenance - and development of working competences of employees (knowledge, skills and attitudes) is managed on individual nuclear facilities according to System of Preparation of Employees, which is approved by the regulatory bodies.

System of preparation of employees of nuclear facility is maintained and improved on the basis of operational experiences, realized organizational changes, technical solutions (modernization) on the facility, requirements of the regulatory bodies, audits, checking and recommendations of IAEA. Necessary human, financial and material resources secure this system.

Preparation of own employees as well as third persons (third persons represents suppliers of works) is performed in compliance with the documents of Quality Assurance Program Management, which is built up and maintained in accordance with:
- generally binding legal regulations of the Slovak Republic,
- regulations, recommendation and guides of IAEA,
- standards of the series STN EN ISO 9001:2000 a 14001:1996,
- documentation of management in the Quality system of SE, a. s.

Quality control and tests of technical equipment by course of the Act No. 95/2000 Coll. as amended by the Act No. 231/2002 Coll. and implementary degrees, can perform only specially skilled employees, which have Testification issued by bodies of work inspection. Analogous system is solved by legislation also for operating personnel of technical equipment. The National Inspectorate of Work and the

Technical Inspection verify professional capability of these employees and relevant Testification is issued by National Inspectorate of Work or by Inspectorates of Work.
The top document in the Quality Assurance System for whole area of human resources is „Concept of SE, a. s.´ Human Resources Management“. Linked with this top document is documentation for management in the area of human resources, including preparation and development of employees and management in the board of management of SE, a. s. and individual nuclear facilities.
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 job positions superior to the selected employees, such as deputy director for operation, engineer-in-chief, head of operation management department, head of nuclear safety department and head of reactor physics department must have academic education of technical / natural sciences orientation on physics and must have verified professional capability which further verification is not 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.

Schedules of preparation
Basic preparation (theoretical preparation, simulator training, educational stays, practice on working place) and periodical preparation in specialized facility for employees who perform working activities important from the point of view of nuclear safety, are performed according to programs approved by ÚJD SR on the basis of proposal of specialized educational and training facility, which is authorized on preparation of selected employees.

Programs of preparation are elaborated for each category, profession group and subgroup of employees individually, with consideration of types and stages of preparation. They determined aims, content, extent, term of preparation, forms of education and way of verification of knowledge.
Authorization for preparation of employees in the area of occupational safety and health protection and in the area of safety of technical equipment is issued to legal person according to the Act No. 95/2000 Coll. in wording of the Act No. 231/2002 Coll. by MPSVR SR. NLI at verification of professional capability of educational and training centre, review especially:

a) contents and extent of the project,
b) professional and pedagogical qualification of lectors and instructors,
c) material securing.

Considerable element in increase of qualification of employees is co-operation with universities, especially by form of postgraduate and distance education on the Slovak Technical University, Economic University and Comenius University in Bratislava.

F.2.2 Financial resources

By the Act No. 254/1994 Coll. with effect from 1 January 1995 the State Fund of decommissioning nuclear power generating installations and treatment of spent nuclear fuel and radioactive waste was established. Mentioned Act was afterwards amended by the following acts: Act No. 78/2000 Coll. and Act No. 560/2001 Coll. The main aim of amendments was especially modification how to create and

use the resources of the Fund.
The Ministry of Economy of the administers the Fund and the fund resources are controlled on the special account in the National Bank of Slovakia. The Fund is created from the following resources:

- contributions of operators of nuclear facilities,
- penalties awarded by ÚJD SR to operator in accordance with special regulation,
- bank loan,
- interests from fund resources deposited in bank,
- subsidies from state budget,
- other resources.

The basic resources of the Fund are contributions of operators of nuclear facilities. In compliance with above mentioned act, operator of nuclear facility is obliged to contribute yearly to the Fund the sum 350 000 Sk for each megawatt of installed electric power of the nuclear facility and 6,8 % from sales price of electric power generated yearly in the nuclear facility.
It is possible to provide resources of the Fund as specific subsidy to the operator of nuclear facility or spent fuel and radioactive waste repository and to the person determined for the management of orphan sources on the basis of written application accompanied by the project with technical and economic reasoning.

It is possible to use the Fund resources for:

a) decommissioning of nuclear facilities,
b) management of spent fuel and radioactive waste after the end of nuclear facility operation (where were originated),
c) management of orphan sources and waste from illicit trafficking when originator is unknown,
d) purchase of site for spent fuel and radioactive waste repositories,
e) research and development in the area of decommissioning of nuclear facilities and management of spent fuel and decommissioning radioactive waste,
f) investigation of sites, geological survey, design, construction, commissioning, operation and closure of spent fuel and radioactive waste repositories including monitoring after their closure,
g) expenses related to the Fund activities up to 0,3 % of annual income of the Fund,
h) contributions on protection of life and health of population in the hazard area of nuclear facility.

F.3. Quality assurance system of the operator

F.3.1 History of the SE, a. s. quality system builds up

Build up and introduction of the SE, a. s. Quality System (QS) is based on:

- fulfilment of requirements of the legal basis of the Slovak Republic,
- fulfilment of international conventions,
- realization of internal needs of the company to build up effective management system.

SE-VYZ, SE-EBO a SE-EMO began to build up their quality systems in accordance with the ČSKAE Order No. 5/1979 Coll. about quality assurance of classified equipments in nuclear power industry from the point of view of nuclear safety. After issue of ČSKAE Decree No. 436/1990 Coll. about quality assurance of classified equipments from the point of view of nuclear safety of nuclear equipment, the process was even intensified. Quality assurance programs for operation were conceived as wider, going beyond the scope of requirements of the above-mentioned decree. In this process the experience of West European nuclear power plants was used, or more precisely, experience of companies, which operate nuclear power plants, as for example MAGNOX ELECTRIC - Great Britain and IVO - Finland.
SE-EBO, SE-EMO, SE-VYZ use now quality systems (Quality Assurance Programs), which satisfy legislative requirements of the Slovak Republic. These systems should be permanently improved in accordance with enhanced requirements on quality assurance in nuclear power plants.

F.3.2 Quality strategy

Managements of SE-EBO, EMO, VYZ have issued quality strategy, which determines principal aims and basic directions of their activities in ensuring of safe, reliable and effective operation of nuclear facilities, with minimum environmental impact.
In 1994 joint-stock company Slovenské elektrárne was established. The branches of the Company are SE-EBO, SE-EMO, SE-VYZ. Progressive transfer of legal personality to the management of the joint-stock company take place also in the area of responsibility for nuclear and radiation safety, technical safety and health protection. Managing board of the joint-stock company has decided in 1996 to build up unified quality system within the whole joint-stock company. The SE, a. s. Quality Strategy was declared and the Plan of Quality System Elaboration was issued. Board of Directors of SE, a. s. has created all assumptions for build up of unified Quality System within the whole joint-stock company.

Quality Concept

1. The major objective of Joint Stock Company Slovenské elektrárne is to satisfy the requirements of the customers for a good quality and reliable supplies of electricity and heat.
2. The Joint Stock Company Slovenské elektrárne achieves the above objective through safe, reliable and efficient operation of power plants, thermal plants and the electricity grid, the safety of nuclear sources representing top priority at any stage of their life cycle.
3. All activities are managed so as to minimize negative impacts on the environment, health and safety of the public and to comply with the applicable legal system, authorizations and decisions issued by the corresponding State regulatory authorities.
4. Development, implementation and continuous maintenance of the quality system has been the basic tool for the achievement of this objective.
5. The Joint Stock Company Slovenské elektrárne has committed itself to develop and implement a unified and effective quality system for the entire Company which shall be in accordance with the requirements of the legal framework of the Slovak Republic, STN EN ISO 9000 standard series, and the International Atomic Energy Agency's series recommendations contained in document 50-C-Q.
6. The main principles of the quality system are as follows:
   - any employee is responsible for the quality of work he/she is performing,
   - any safety-related activities are performed in compliance with the regulations,
   - the system is based on proven experience as well as on good domestic and international experience.
7. The development, implementation and continuous monitoring and evaluation of the efficiency, as well as further development of the quality system including employees training are the responsibility of the Board of Directors of Joint Stock Company Slovenské elektrárne.
8. Requirements of this Quality Concept shall be reflected in a Quality System Handbook and in the related Quality System documentation.
9. This Quality Concept shall be binding to all employees who have to be informed about its content. Every employee shall be obliged to follow it, implement it, and take effective measures in developing and implementing the corresponding parts of the Quality System at his/her level of activities.
10. Control of the compliance with the principles set forth by this Quality Concept shall be the responsibility of Director, Quality Assurance Department.

SE, a. s. Quality System is build up as unified management system, which contains all activities and processes realized within SE, a. s. and which meets requirements of:

- regulations and rules of the Slovak Republic system of law
- standards of series ISO 9000 and ISO 14 000
- requirements of IAEA

SE, a. s. Quality System is structured:

- according to organizational structure of SE, a. s.
- according to activities - processes performed in SE, a. s.

SE, a. s. Quality System structure according to organizational structure of the company

SE, a. s. Quality System consists of the following parts:

- Quality System of the Board of Management of the Slovenské elektrárne
- Quality Systems of branches
- Model Management Documentation

Exemplary documentation of management for branches, has task to prescribe for individual activities - processes exemplary procedure of execution of those responsibilities and competences, which are within the scope of given activity delegated to the branches. On the ground of exemplary documentation, the branch (SE-EBO, SE-EMO, SE-VYZ, ...) elaborates documentation of its own quality system. SE, a. s. Quality System has scope of power on all organizational components of the company.

SE, a. s. Quality System structure according to activities

SE, a. s. Quality System is based on activities - processes, which are important for fulfilment of mission of the company. These activities are chosen in order to cover all processes performed in individual manufacturing plants and organizational components of the company and to take relevant specificities into account. It means, that it takes into account requirements not only from the point of view of output product, but all requirements exercised on the process of production and distribution of electric energy and heat, that is requirements on safety, reliability, efficiency and protection of environment. Therefore we can speak about SE, a. s. Quality System as about management system.

Activities are divided into three groups as follows:
- Basic activities of the Quality System - those are activities, which are derived from fulfilment of requirements of standards on Quality System and are usually realized in each organizational component.
- Specific activities important from the point of view of nuclear and radiation safety - these are activities specific for nuclear power industry and have aim to ensure fulfilment of requirements on nuclear and radiation safety and their inspection
- Further specific activities - activities, on which there are not directly defined requirements of standards for Quality System, but which however, to a large extent, influence operation and management of the company, or which can be specific for certain organizational components, as for example, water power plants, standard power plants, transmission system, or board of management of Slovenské elektrárne.

F.3.3 Project of elaboration and introduction of Quality System in SE, a. s.

Build up and introduction of SE, a. s. Quality System is realized in compliance with Plan of Project of Quality System Elaboration and Introduction in SE, a. s. (thereinafter only Plan). The Plan except that describes the SE, a. s. Quality System structure, and SE, a. s. Quality System documentation, also determines:
- organizational assurance of realization of the Project of Quality System Elaboration and Introduction in SE, a. s.
- training of SE, a. s. employees for assurance of realization of the Project of Quality System Elaboration and Introduction in SE, a. s.
- time sequence of realization of the Project of Quality System Elaboration and Introduction in SE, a. s.
- sources and support necessary for realization of the Project of Quality System Elaboration and Introduction in SE, a. s.

In relation to present Quality Systems in SE-EBO, SE-EMO, SE-VYZ, the introduction of unified SE, a. s. Quality System has also function of unification or convergence of these systems with exploitation of their best properties.

F.3.4 Examination of efficiency of SE, a. s. Quality System

Efficiency of SE, a. s. Quality System, but also efficiency of quality systems of SE-EBO, SE-EMO, SE-VYZ is examined by:
- internal audits which are determined by the system itself
- audits, inspections and checking which are performed by regulatory authority (ÚJD SR)

Findings uncovered during audits, inspections or checking are analysed on appropriate levels of management, where are accepted corrective and preventive measures realization of which is checked. Thereby is ensured continual improvement of SE, a. s. Quality System.

F.3.5 Role of regulatory body

Activities and tasks of ÚJD with respect to the exercise of State regulation in the field of nuclear safety of nuclear installations and quality assurance are set forth in Act No. 130/1998 Coll. and CSKAE Decree No. 436/1990 Coll. The mentioned Decree lays down requirements and criteria for quality assurance at selected installations from the viewpoint of nuclear safety of nuclear installations. The Decree establishes basic requirements on quality assurance of selected installations as well as the requirement for the development of quality assurance programs. ÚJD SR regulates the organizations responsible for the quality assurance of selected installations as mentioned in the Decree and checks their compliance with these requirements how such quality assurance programs are being implemented. Both ÚJD SR and the responsible organizations - operators of nuclear installations accept the International Atomic Energy Agency's documentation, and use them as widely as possible in defining their own criteria and procedures related to the assurance of nuclear safety and quality at selected installations.

ÚJD SR's philosophy in this respect is based on the fact that in addition to nuclear installation design, multiple barriers and appropriate technical and organizational measures, nuclear safety of every nuclear installation is also achieved through the required quality of selected installations and the corresponding activities. The quality system described by quality assurance program serves to maintain and develop quality.

In exercising State regulation in the field of quality assurance, ÚJD SR focuses on two basic activities:

1. Approval of quality assurance systems

This is done at two levels:
- Review, approval and control of quality assurance input programs of the responsible organizations and of partial programs of quality assurance for specific stages of the nuclear installation life cycle

as set forth by the input program (e.g. design, construction, start up, operation, decommissioning etc.).

- Review, approval and control of individual programs of quality assurance developed for the individual selected installations or groups of selected installations in accordance with the classification by their significance with respect to nuclear safety.

2. Inspections of quality assurance programs implementation

ÚJD SR inspectors use quality assurance-related inspections to also check how the responsible organization in question and its suppliers meet the requirements laid down by CSKAE Decree No. 436/1990 Coll., the criteria set forth by ÚJD SR decisions issued, and how they implement the approved documentation of quality assurance. As soon as the respective quality assurance program has been approved, inspection activities focus on the control of meeting of its individual requirements and on the practical implementation of the requirements, i.e. compliance of actual activities with approved documented procedures. The draft protocols of the inspections are consulted with the managers of the responsible organizations. If non-compliance is identified at selected installations concerning activities or documents, inspectors are authorized to order measures to eliminate such discrepancies. Inspections are performed according to the approved program, they have their objectives and a documentation format.

In addition to the above mentioned activities in the field of supervision of quality assurance regulation at selected installations, ÚJD SR is also responsible for the enforcement if requirements set forth in applicable generally binding legal regulations or ÚJD SR's decisions or by inspections are not met. As a rule, this is mostly done by negotiating with the responsible organization, withholding of approval of inappropriate quality assurance programs, follow-up or extraordinary inspections and - as a last resort - by imposing penalties.

F.4. Radiation protection

F.4.1 Legislation in radiation protection and its implementation

The Act No. 272/1994 Coll. on Human Health Protection as amended by the Act No. 290/1996 Coll., Act No. 470/2000 Coll., Act No. 514/2001 Coll., and Decree of MoH SR No. 12/2001 Coll. is based on the philosophy of the recommendation ICRP 60 of 1990, International Basic Safety Standards, SS No. 115 of 1996, and also respects provisions of EU Council directives and regulations for radiation protection.

F.4.2 Implementation of radiation protection legislation

The Act No. 272/1994 Coll. as amended by later regulations and the respective Decree No. 12/2001 Coll. implements all directives and regulations of the Euratom Council related to the issue of radiation protection in nuclear facility, such as:

- Directive of the Council No. 96/29/Euratom of 13 May 1996, which establishes the basic safety standards of personnel and public health protection against dangers due to ionising radiation,
- Directive of the Council No. 90/641/Euratom of 4 December 1990 on protection of external staff exposed to the ionising radiation risks during their activities in the controlled area,
- Regulation of the Council No. 89/618/Euratom of 27 November 1989, which specifies the way of the public informing on health-protection measures taken in case of a radiological danger,
- Regulation of the Council No. 87/3954/Euratom of 22 December 1987 as amended by the Decree of the Council No. 89/2218/Euratom of 18 July 1989, which specifies maximum allowable values of radioactive contamination of foods and fodders following a nuclear accident or other radiological danger,
- Regulation of the Council No. 90/770/Euratom of 29 March 1990, which specifies maximum allowable values of radioactive contamination of fodders following a nuclear accident or other radiological danger.

The quality assurance system of Slovenske elektrarne, a. s., has implemented the applicable acts in the "Basic Directive“ for radiation protection. Subsidiaries of SE have incorporated the national legislation as well as recommendations of international organisations (ICRP and IAEA) in directives, work procedures, human exposure limits, and limits for release of radioactive substances into the atmosphere and waters.

Based on the ALARA Commission recommendations, dose and exposure limits for the staff and individual SE-VYZ staff categories have been specified for the one-year period, while the set intervention levels, where the cause of exceeding is assessed and relevance justified, are lower than legislation-set limits.

Radiation protection principles, particularly the ALARA principle and dose and risk limiting principle, are considered for all works.

Limits for release of radioactive substances into the environment are subject to approval by regulatory authorities. The limits are purposed to ensure that effective doses of an individual of the population in normal and abnormal operational conditions will not be exceed limits specified by the national legislation and international recommendations.

F.4.3 Systems of atmospheric and hydrospheric emission monitoring

Atmospheric emissions are monitored continuously by measurement instrumentation located at venting stacks in accordance with the Chief Hygienist's decision. The instrumentation monitors the activity of gases, aerosols, tritium, C-14 (SE-EBO only) and iodine continuously. In addition to that, aerosols are continuously sampled for balance filters, which are subsequently gamma-spectrometric analysed in laboratories, where the contents of alpha-nuclides and Sr90 are determined.
Discharges to the hydrosphere are monitored continuously in order to record deviations from the normal conditions. For the purpose of balancing, the activities in waste water are monitored by measurement of tritium activity concentration, activity concentration of corrosion and fission products (isotopes) and strontium obtained by sampling from tanks prior to discharging.
Limits of radioactive discharges into the atmosphere and hydrosphere are shown in the Annex.
The values of atmospheric and hydrospheric radioactive emissions from SE-EBO and SE-EMO in 2001 are shown in the following tables. No radioactive emission limits were exceed crossed in 2001 as well as in all previous years, while the emissions of corrosion and fissions products and atmospheric emissions were deep below the authorised limits.

Table F. 4.1a.)

Atmospheric emissions in 2001			
Facility	**Type of emission**	**Activity**	**Per cent of the limit**
V1 NPP	Inert gases	15.41 TBq	0.38
	Aerosols	175.65 MBq	0.10
	Iodine 131	558.27 MBq	0.83
V2 NPP	Inert gases	7.99 TBq	0.19
	Aerosols	10.28 MBq	0.006
	Iodine 131	1.82 MBq	0.003
MOCHOVCE NPP	Inert gases	12.712 TBq	0.310
	Aerosols	14.65 MBq	0.010
	Iodine 131	17.77 MBq	0.022
ISFS	Aerosols β	12.48 MBq	4.16
A1	Aerosols β	20.70 MBq	2.20

Table F. 4.1b.)

Discharges into hydrosphere in 2001			
Facility	**Type of emission**	**Activity**	**Per cent of the limit**
EBO+VYZ	Corrosion and fission products	139.99 MBq	0.37
Recipient: Vah river	Tritium	18 383.27 GBq	42.07
MOCHOVCE	Corrosion and fission products		
NPP	Tritium		

F.4.4 Monitoring of environmental impacts

A nuclear power plant environmental impact assessment, including the spent fuel and radioactive waste management, is a part of the radiation protection of nuclear facility. The environmental impact assessment start in fact with the pre-operational monitoring of radiation at the considered nuclear power plant site and its surrounding. The acquired set of data is then used for comparison of the nuclear power plant environmental impacts.
A site survey and analysis were performed prior to Mochovce NPP commissioning. The results are processed in the epidemiological study: Health conditions of the population living around Mochovce

Nuclear Power Plant" (1999). The study summarizes results of a detailed survey and assessment of the area with radius of 20 km around the NPP based on health indicators. The Report provides an exhaustive description of the public health conditions in the area prior to Mochovce NPP commissioning as the basis for the future impact assessment, gives assumptions of further development, and defines areas and issues to be the focused in the future.

The nuclear power facility environmental impacts are monitored by the Off-site radiation monitoring laboratories. The monitoring scope is determined by the monitoring programme, which defines obligatory minimum numbers and types of monitored environmental elements. In the view of possible nuclear power facility impacts, the monitored environmental elements include: air, water, soil, and agricultural products as a part of the food chain affecting a man. Every year more than 1,150 samples of the environment are taken.

A teledosimetry system has been built up around Bohunice NPP to improve the monitoring of nuclear power facility impacts on the immediate environment. The teledosimetry system is controlled by computer technology and allows for sampling of aerosols, radioiodine, dose-rates, and meteorological data. The monitoring results made by the teledosimetry system are on-line transmitted to CCC ÚJD SR.

To assess the impact of Bohunice and Mochovce NPPs on the surrounding population, due to low volumes of emissions to the atmosphere and water flows, doses to the population are analysed based on real effluents of radioactive substances in particular years considering a real meteorological situation according to data of SHMU meteorological station at Jaslovske Bohunice and Mochovce

This analysis is performed using a standardised computing software RDEBO, or RDEMO respectively, which calculates the individual dose equivalent (IDE). The results show that the area of the highest effective dose equivalent is located in the direction of prevailing winds. In case of Bohunice it is S and SS-E in the distance of 3 to 5 km (Malzenice village) and the critical age group is the population of 7 to 12. In case of Mochovce it is ES-E in the distance of 3 to 5 km (Novy Tekov village). The critical age group are infants.

Table 4.6.3.3a.) Calculated IDE for population groups around Bohunice NPP

Year	IDE [Sv]		
	Infants	Age of 7-12	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
2001	1.79E-7	2.31E-7	2.28E-7

The IDE are considerable lower than IDE received by the population from the natural background. The individual dose equivalent from the natural background around Bohunice and Mochovce NPP is 100 to 10000 times higher than the values presented in the tables. Moreover, IDE calculations are characteristic with a considerable conservativeness and are actually overvalued as compared to the real ones, since the entry data estimate, particularly the consumption of foods grown in the local area and water, and their impact on the result of the radiological impact calculation, is complicated.

Calculation results for the three most loaded population groups in the both areas are presented in the tables 4.6.3.3a.) and 4.6.3.3b.)

In addition to the monitoring performed by nuclear facility themselves, environmental impacts of nuclear facility operation are monitored by regulatory authorities (NCHI), and complementary monitoring of the Bohunice A1site is ensured by VÚJE.

Table 4.6.3.3b.) Calculated IDE for population groups around Mochovce NPP

Year	IDE [Sv]		
	Infants	Age of 7 - 12	Infants
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
2001	5.82E-7	4.23E-7	3.17E-7

NCHI monitors integral doses in the system of monitoring points around NPPs by the method of thermo-luminescent dose-meters, discontinuous dose-rate measurements in the system of monitoring points around NPPs, monitoring of activity of corrosion and fission product in fall-outs, aerosols, potable, surface and ground waters, in the soil, sediments, agricultural products and food chain elements produced in the vicinity of nuclear facility, random parallel analyses of aerosols in discharges and samples from waste water collection tanks prior to discharging.

Slovak Headquarter of the Radiation Monitoring Network (SHRMN) is a permanent executive component of the Governmental Commission of Slovakia for radiation accidents, which ensures methodical preparation of monitoring network components and their unified procedure in radiation situation monitoring.

SHRMN has been established in the Institute of Preventive and Clinical Medicine in Bratislava and constitutes a part of it. The head of SHRMN is appointed by the minister of health based on the proposal by the Commission Chair.

At the time of a radiation accident SHRMN is subordinated to the minister of health.
SHRMN is composed of the following components involved in monitoring of the radiation situation in the Slovak Republic:

- monitoring system of the Slovak Hydro-meteorological Institute,
- monitoring system of the Army,
- monitoring system of MoI SR - CP Office,
- monitoring system of MoH SR,
- monitoring systems of NPPs.

Results of direct measurements in stable monitoring stations, results of sample assessment from the surrounding environment and analysis calculations of impacts of radioactive substances on the population show that environmental impacts of operation of Bohunice and Mochovce NPPs, radwaste treatment and conditioning technologies, and ISFS - SE-VYZ is measurable, however the operation has only negligible impact on the population and environment.

F.4.5 Activities of regulatory authorities

In accordance with provisions of respective legal documents, persons performing the national health supervision are authorised to enter plants and buildings, require information, take samples, make findings, and look at particular documents. In performing the supervision activities they focus on following the generally binding legal regulations, conditions defined in licence, measures and instructions issued by a health protection authority.
The radiation protection inspection is ensured by:

- the system of information that the operator provides to a supervision office based on conditions defined in the licence for performance of activities resulting in irradiation,
- on-site inspections.

According to the purpose, the inspections usually include radiation situation monitoring in a work environment, in the vicinity of nuclear facility, and in referential sites by own technical equipment. The purpose of the measurement is to provide an objective assessment of a nuclear facility operation impacts on the working as well as surrounding environment.
When performing the national health supervision on radiation protection, the staff monitor the following in particular:

- radiation situation in a nuclear facility, while performing their own measurements,
- adherence to approved documentation,
- personnel doses, register of personnel doses in the nuclear facility, while performing their own analyses of the personnel doses,
- monitoring of discharges, while performing random check-measurements of some radioactive discharge parameters,
- application of radiation protection optimisation,
- professional and health capability of personnel, management personnel, and radiation protection specialists,
- documentation essential in terms of health protection against ionizing radiation,
- conditions for releasing radioactive substances into the environment,
- preparedness of nuclear facility to radiation accidents and emergencies,
- impact of a nuclear facilities operation on radioactivity of the environment components and population doses, while performing their analyses of the environment component radioactivity,
- performance of the off-site radiation monitoring laboratories, etc.

Based on the observations the supervision staff prepare documents for a health protection authority decision-making on exposure-related activities, and in taking measures, giving instructions or sanctions.
The national health supervision in the area of work environment performs monitoring of dose rates, aerosol activity, surface contamination, or other special measurements. In the vicinity of a nuclear facility they perform monitoring of integral doses in the TLD method and discontinuous measurements of dose rates in the monitoring point system, monitoring of activity of corrosion and fission products in fall-outs, aerosols, potable, surface and ground waters, in the soil, sediments, agricultural products and food chain elements produced in the vicinity of nuclear facility. Parallel analyses of aerosols in discharges and samples from waste water are done on a random basis.

F.5. Work safety and health protection and safety of technical equipment

F.5.1 Legislation in work safety and health protection, and safety of technical equipment

Inspection of work in the nuclear engineering is based on the Acts No. 95/2002 Coll. and No. 330/1996 Coll. and is split into two parts:

Part 1 includes the State supervision focused particularly on the inspection of technical equipments. The inspection activities are performed according to:

- the Decree No. 66/1989 Coll. on ensuring safety of technical equipment in the nuclear engineering as amended by the Decree No. 31/1991 Coll.
- the Decree No. 718/2002 Coll. on ensuring work safety and health protection and safety of technical equipments.

The work inspection consists of (Decree No. 66/1989 Coll. as amended by Decree No. 31/1991 Coll.):

1. Inspection and issuance of positions on materials and activities.
2. Review of professional capability of legal and physical entities and issuing of:
   - certificates for performance of production, assembly, repairs, refurbishments, maintenance, tests,
   - certificates for performance of tests and validation of technical documentation.
3. Participation at tests (e.g. civil, pressure, tightness ones, etc.).
4. Endorsement of technical documentation of equipments.

Moreover, according to the Decree No. 718/2002 Coll., the work inspection consists of:

1. Inspection of:
   - the technical documentation of classified equipment,
   - performance of professional checks and tests, etc.
2. Issuance (check) of authorisations for legal and physical persons for particular activities and verification of their knowledge related to the activities.

Part 2 includes the State supervision focused on the inspection of adherence to other regulations to ensure work safety and health protection and safety of technical equipments.

The work inspection consists particularly of inspecting the adherence to provisions of:

- Act No. 330/1996 Coll. on Work safety and health protection as amended
- Decree No. 111/1975 Coll. on record keeping and registration of occupational injuries and announcing of operational accidents and technical equipment failures as amended by the Decree No. 483/1990 Coll.
- Governmental Resolution No. 504/2002 Coll. on Conditions of providing personal protective devices
- Decree No. 59/1982 Coll. that defines the basic requirements on ensuring the work safety and health protection and safety of technical equipment as amended by the Decree No. 484/1990 Coll.
- Decree No. 374/1990 Coll. on work and technical equipment safety at civil works.
-

F.5.2 Technical inspection

Technical inspection activities in the nuclear engineering are performed in accordance with the Act No. 330/1996 Coll. as amended by later regulations, and consist of review of technical equipment safety requirement fulfilment.

The technical inspection

a) provides professional and binding positions on whether the technical equipment safety requirement are fulfilled in design, construction, manufacturing, operation, attendance, repairs, maintenance, special tests of the technical equipments,
b) performs reviews, controls and assesses tests of the technical equipments,
c) reviews professional capability of legal persons for manufacture, assembly, repairs, maintenance, special review and tests of the technical equipments,
d) reviews professional capability of physical persons for exams, special review and tests, repairs or attendance of the technical equipments,
e) ňcertifies whether the technical equipment, material and documentation of civil constructions, technical equipment, technologies, machine and equipment prototypes meet technical equipment safety requirements.

F.5.3 Implementation of legislation related to the work safety and health protection and technical equipment safety

The implementation is applied in accordance with acts and regulation of the Slovak Government shown in the Annex No. VI.

F.5.4 Task of the work inspection regulatory authority

Supervision in the area of work safety and health protection and technical equipment safety is performed by inspectors of the National Inspectorate of Work according to § 5 par. 3 letter f) of the Act No. 95/2000 Coll. as amended by the Act No. 231/2002 Coll.
The inspection activities are performed at all workplaces of a nuclear facility operator, as well as at legal and physical persons who provide the manufacture, assembly, repairs, refurbishments, maintenance, and tests of the technical equipments for the nuclear power industry.
In performing their activities (chap. E.2.3) the NLI inspectors are authorised to:

a) freely enter workplaces subject to the work inspection at any time,
b) perform inspection, test, investigation, and other tasks with the aim of finding whether the procedures establishing work protection requirements are followed,
c) use technical means for making a photo-documentation, video-documentation, and audio-recordings necessary for the inspection performance, unless the use of the above is not restricted by special regulations,
d) direct performance of measurements, checks, tests, and other operations necessary for the inspection performance.

Based on the inspection results and according to the seriousness of findings, NLI inspector is authorised to:

a) suggest technical, organisational, and other measures necessary for improvement of the conditions found,
b) direct rectification of the found deficiencies immediately or in deadlines specified by him/her,
c) submit a proposal for a fee due to breach of duties or non-accomplishment of NLI-directed measures.

Legal persons have the following duties to NLI:

a) inform without delay in writing on
    1. start of operations, as well as the character and scope of activities, essential changes and termination of operations,
    2. occupational injuries, operational events, technical equipment failures, industrial poisoning, occupational diseases, as well as circumstances of the occurrence,
b) submit for assessment developed procedures related to the work safety and health protection

Measures in pre-manufacture, manufacture, and product introduction to a market, general prevention principles, duties of the employer and employee are specified by the Act No. 330/1996 Coll. as amended by later regulations.

F.6. Emergency preparedness

F.6.1 Legislation in the area of emergency preparedness

Currently the emergency preparedness legislation is based on acts and degrees of departments having the largest share in emergency preparedness and planning, particularly the following:

- Act No. 130/1998 Coll.,
- Act No. 272/1994 Coll.,
- Act No. 42/1994 Coll.,
- Act No. 129/2002 Coll.,
- Decree of ÚJD SR No. 245/1999 Coll.,
- Decree of MoI SR No. 300/1996 Coll.,
- Decree of MoH SR No. 12/2001 Coll.,
- Directive of MoI SR, MoH SR and ÚJD SR No. CO – 187/374/2000.

All the above emergency-preparedness-related documents reflect recommendations of the International Atomic Energy Agency in Vienna, and applicable directives of the European Union, such as:

- Safety Series 50-SG-06: Operator’s preparedness to emergency situations at NF,
- Safety Series 50-SG-66: Preparedness of public administration authorities to emergency situations at NF,
- Safety Series 55: Emergency response planning in NF surroundings in case of a radiation accident at NF,
- Safety Series 72. Rev. 1: Protection in uncontrolled radioactivity source accidents,
- TEC DOC 953 – Methods of emergency response preparation for nuclear and radiation accidents,
- TEC DOC 955 – Basic assessment procedures to determine protective measures for reactor accident,

- 82/501/EHS: Directive of the Council of 24 June 1982 on risks brought by serious accidents in certain industrial activities,
- 87/600/Euratom: Decision of the Council of 14 December 1987 on establishment of the Union's set of measures for a quick information-exchange in case of a radiological emergency,
- 89/618/Euratom: Directive of the Council of 27 November 1989 on informing the general public about health protection measures to be applied and steps to be taken in case of a radiological emergency.

F.6.2 Emergency preparedness legislation implementation

National organisation of emergency preparedness

To ensure necessary measures to cope with a nuclear facility emergency and measures to protect the public and economy during events with environmental impacts, the national emergency preparedness organisation (Fig. F.6.2) is split to three levels.

The first level is formed by emergency committees of nuclear facilities with the prime function comprising the control of works and measures on nuclear facility sites so as to allow for check of technological equipment conditions, and the control of measures to cope with emergency and mitigate consequences on personnel, plant, environment, and public.

The second level is established on the regional level, and is formed by Regional and district radiation accident committees, whose territory stretches to the threatened area, where a danger can be posed to life, health, or property, and where the public protection measures are planned. This area is determined to a circle with radius of 30 km around Bohunice NPP and 20 km around Mochovce NPP.

The third level is formed at the national level by the Emergency Commission of the Slovak Government (EC) with its support components and Emergency and Safety Committee of SE, a. s. The task of EC is to co-ordinate and control the preparation of measures focused on the protection against a radiation event consequences. The task of the Emergency and Safety Committee of SE, a. s. is mainly to organise and co-ordinate a quick mitigation of consequences of severe events and emergencies at generation plants or distribution equipment. Since October 2002 the above structures have been complemented with the Central Crisis Headquarter (CCH) that is an executive body of the Safety Council of SR (SC SR). The recent CRA now provides the technical support to CCH.

Support components of CRA are the following:

- Control and Emergency Centre (CCC) of ÚJD SR is a technical support centre of ÚJD SR for monitoring of NF operation and assessment of technical conditions and radiation situation in case of a nuclear or radiation event, and for making prognosis of the event development and consequences according to the Act 130/1998 Coll. It is also a technical support centre for OMG established as a part of CRA.
- Operative-managing group (OMG) is a specialised consulting body of CRA established based on the CRA's statute and decree. The OMG's task – based on a situation assessment in case of a NF event - is to process data and one common recommendation of involved departments for decision-making on measures to protect the public on the CRA level. In making the recommendations it is closely co-operating with CCC ÚJD SR.
- The Slovak Center of the Radiation Monitoring Network (SCRMN) is a technical support body established by MoH SR, where data from all radiation monitoring systems on the whole territory of Slovakia are centralised and assessed. This body has been established based on the CRA's decree and statute.

Emergency documentation

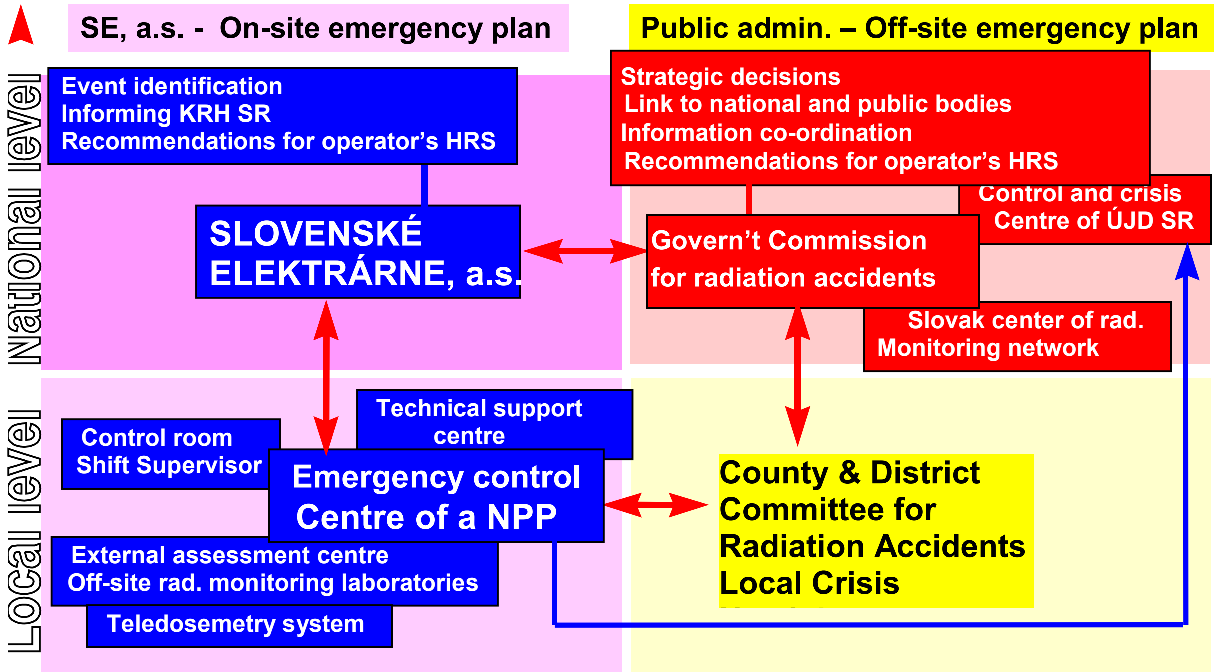
To cope with events at nuclear facilities and their consequences on the environment, an emergency documentation has been created, which defines a procedure and work organisation during every single level of emergency at various levels of emergency preparedness described in the chapter F.6.2.

A nuclear facility operator has developed on-site emergency plans, which define the emergency response organisation and its implementation related to emergency situation management and staff protection, including the staff health protection in the medical measure plan. In addition to that, the operator has developed operational procedures, which allow for identification and classification of the emergency event in line with international recommendations. There are emergency procedures and activity plans of ECC ÚJD SR and Failure Committee of SE, a. s. developed at a national level.

The National Emergency Plan has been developed recently, which summarizes all procedures and measures of members of the Slovak Governmental Committee for Radiation Accidents. The National Emergency Plan (NEP) is binding for CRA members. There are the off-site emergency plans developed at a regional level for a case of a nuclear accident. The plans include measures for protection of the public, health, property, and the environment, as well as a link to the on-site emergency plan.

Provisions of the national legislation, as well as international recommendations of IAEA and directives of the European Union are fully applied in all the above plans.

Figure F.6.2 National organisation of the emergency preparedness of SR



F.6.3 Operator's on-site emergency 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 (ECC) 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,
- Technical Support Center (TSC) 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 (OSC) 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 SR, the Slovak Energy Control Center (SED) and subsequently to the emergency service of SE, a.s.
The informing in an emergency includes regulatory authorities (ÚJD SR, NCHI), SE, a. s. Headquarters, Slovak Headquarters of Radiation Monitoring Network (SHRMN), and regional-level

emergency committees (district and Regional). Information flow about conditions of technological equipment and critical safety functions between a NPP and CCC ÚJD SR is on-line based on the Act No. 130/1998 Coll. and the agreement between SE, a. s. and ÚJD SR.

F.6.4 Off-site emergency plans

Regional Offices, District Offices, and settlements, whose territories are located in the threatened area of SE-EBO and SE-EMO develop the public protection plans for a case of a nuclear accident in a nuclear facility (hereafter referred to as “off-site emergency plans“).

The off-site emergency plans are linked to a NF operator’s on-site emergency plan. The operator is obliged to provide the off-site emergency plan developers with data on anticipated threat in case of an incident or accident.

The off-site emergency plans are developed in co-ordination with MoI SR and after an assessment by ÚJD SR and other state administration bodies, and approval by the Chief of a respective Regional or District Office, are submitted for endorsement by MoI SR.

After occurrence of an emergency, which has a character of NF radiation event, the Regional, district, or local offices ensure measures following from the off-site emergency plans. For this purpose they create Regional and District Radiation Accident Committees, which have a statute of consulting, co-ordination, and managing body of the Chief of the Regional or District Office for unified preparation and implementation of measures to protect the public and economy in case of radiation event. Activities of the above committees are topped by the Governmental Committee of Slovakia for Radiation Accidents, which is a managing, consulting, and co-ordination body of the Government of Slovakia. RCRA and DCRA, or CRA respectively are involved in the emergency response organisation (hereafter referred to as ERO) to prevent delay-caused danger in fulfilling tasks related to the public protection).

In case of a radiation accident related to a release of radioactive substances, the NF operator immediately ensures public warning and informing the people involved in management of consequences of emergencies, in line with the on-site emergency plan, off-site emergency plan, and based on the technology conditions assessment, identification of the source element, values measured by the teledosimetry system, primary NF off-site radiation conditions measurement, and meteorological situation. Subsequently the bodies of the state administration, local administration, and local governments ensure further urgent and follow-up measures comprising particularly the iodine prophylaxis, hiding, or evacuation respectively, etc. The measures are taken on territories, which were influenced by the radiation event consequences, including territories, where the event consequences can propagate in terms of prognosis.

Proposals of measures to protect the public are prepared and ensured at all management levels of the local administration and involved departments.

If the radiation event consequences exceed one district territory, the public protection measures are co-ordinated by respective Regional Office. If the radiation event scope stretches over one region, the Slovak Government announces and cancels the emergency for the threatened territory to limit the accident impacts.

In case of a radiation accident CRA continuously monitors the activities of RCRA, makes decisions in support of necessary measures of the off-site emergency plan, creates preconditions for implementation and assesses effectiveness of the measures, and co-ordinated activities of regional committees. Similarly, RCRA co-ordinates activities of respective district committees. For this purpose CRA makes use of conclusions and recommendations made by special and support units (e. g. OMG, CCC ÚJD SR, SHRMN), which usually closely co-operate with RCRA and DCRA.

SHRMN is responsible for radiation conditions monitoring and assessment in case of a radiation event.

Emergency transport procedure

For the purpose of transportation of the nuclear fuel, spent fuel, nuclear materials, and radioactive wastes, the carrier develops emergency transport procedure (ETS) according to the Act No. 130/1998 Coll. and Decree of ÚJD SR No. 245/1999 Coll. The purpose of ETS is to ensure preventive and protective measures in case of an incident or accident during the transport. The NF operator (SE, a. s.) develops ETS for transportation of the above materials on road and rail communications, which come under its administration. Railways of Slovakia (ŽSR) develop the emergency transport procedure for transport on the territory of Slovakia on their railways. After ETS assessment by ÚJD SR and other involved bodies, it is submitted for approval to the Ministry of Transportation, Postal & Telecommunication services of Slovakia.

F.6.5 Systems of public warning and informing

Public warning and informing the bodies, organisations, and personnel is done in accordance with the Act No. 42/1994 Coll. on Civil protection of the public as amended. Competencies and tasks of respective bodies and organisations in ensuring emergency preparedness are specified by the “Agreement on mutual co-operation in ensuring emergency preparedness” between the Civil Defence Office of the Ministry of Interior and SE, a. s. (Fig. F.6.2).

F.6.6 Systems of maintaining emergency preparedness

Personnel of SE-EBO, SE-EMO, SE-VYZ is classified in four categories according to the emergency preparation scope:

- Category I – personnel with a short-term stay in a NF (visits, excursions, etc.),
- Category II – personnel permanently working at a NF,
- Category III – personnel involved in ERO,
- Category IV – mayors of villages and towns in the emergency planning area.

The preparation consists of two parts:

- Theoretical training,
- Practical exercises and drills.

The training plan includes emergency training of the plant personnel according to various job-posts. An independent part is formed by emergency training of the shift personnel. Drills are performed according to yearly schedules with the aim of improving the preparedness of personnel involved in ERO for performance of activities. Emergency drills are taken twice a year at each shift, i.e. shift emergency exercise. Once a year there is a whole site emergency exercise, which involves all personnel of nuclear facilities.

A co-operation emergency exercise is an independent one, and it is usually performed during the site emergency exercise in co-operation with RCRA, DCRA, CRA, CCC ÚJD SR, and other ERO units (fire brigades, health service, army, etc.). The exercise are performed on a regular basis, no less than once in three years with involvement of CCC ÚJD SR and some RCRA, or DCRA respectively. The last co-operation emergency exercise with involvement of CRA, OMG, and SHRMN was held in October 2001. After the exercise completion it s assessed with the assistance of observers and umpires, and measures are taken to improve activities of individual ERO units. The measures are subsequently reviewed and their fulfilment is dealt with by the managements of SE-EBO, SE-EMO, SE-VYZ.

F.7. Decommissioning

A qualified personnel in the whole decommissioning process is required in accordance with the Atomic Act No. 130/1998 Coll. The operator submits a document on personnel qualification to ÚJD SR for assessment when applying for a decommissioning licence.

All works are done by personnel, which is specially instructed by a practical training at mock-ups prior to implementation (according to a work schedule) of technically demanding work operations. All designing, engineering, and implementation activities are performed by organisations (subjects) licensed for the particular activities.

Financial sources. According to the Act No. 130/1998 Coll. the operator is obliged to ensure financial sources throughout the operation to cover expenses related to decommissioning. The funding makes up a part of the income of the National Decommissioning and Radioactive Waste Management Fund (hereafter referred to as the Fund). Accumulation and use of the Fund is described in detail in the chap. F.2.2. The Fund has been created since 1995 and accumulates funding from NPP's operated by SE, a. s. at separated accounts (since 2002). The state is another contributor to the Fund, since A1 NPP and V1 NPP have neither made up nor make up in the future sufficient sources for their decommissioning. Power generation at A1 NPP was terminated prior to the Act No. 254/1994 Coll., by which the Fund was established, came in force. By 1995 the state budget covered all expenses for A1 NPP decommissioning, and since 1995 its decommissioning is covered by the Fund (i.e. by sources deposited to the Fund by SE, a. s.). Some activities after 1995, such as transport of the spent fuel to the Russian Federation, were paid from state budget.

Application of radiation protection measures is ensured in accordance with requirements of the Act No. 130/1998 Coll. and the Act No. 272/1994 Coll. as amended. Continuity of radiation protection procedures and requirements applied during operation of a facility (see F.4.) is maintained in accordance with the safety documentation submitted by the operator when applying for a decommissioning licence. The documentation includes a decommissioning plan characterising radiation sources in the site and radiation protection of personnel and population in the decommissioning process, possible emergencies with a description of mitigation procedures and estimates of consequences (personnel doses obtained during mitigation of the consequences).

Routine activities during decommissioning of A1 NPP are performed according to operational procedures. Non-standard activities are performed according to approved work programmes. Detailed procedure allowing to reach success criteria describes scope and timing of work packages and evaluates the personnel doses using specific protective devices.

Topical problems of exposure control are regularly discussed at "ALARA" committee prior to approval of work programmes. Doses are regularly evaluated by the Nuclear Safety Board of SE-VYZ. The personnel dose evaluation has regularly discussed with NCHI SR representative for SE-VYZ with focus on the most frequent works with high IDE.

Limits for gaseous and liquid discharges are set by the Chief Hygienist and are a part of a documentation submitted to ÚJD SR for approval. The gaseous emissions (in 1996 to 2002) reached ones to tens of MBq that represents ones % of the annual limit. Liquid effluents in the same period reached values (except for tritium) of tenths to ones MBq, that represents tenths to ones % of the annual limit. Tritium activity in liquid effluents (in the same period) was a tenth TBq (except for 1997) that represents tenths to ones % of the annual limit. In 1997 tritium activity reached values of 10^{13} Bq that was 23 % of the annual limit.

Safety documentation for decommissioning licence includes the following, in accordance with requirements of the Act No. 130/1998 Coll. and Degree of ÚJD SR No. 246/1999 Coll. on Documentation of nuclear facilities under decommissioning:

- technical specifications of a safe decommissioning,
- quality assurance programme for decommissioning or for a decommissioning phase,
- on-site emergency plan,
- decommissioning plan or decommissioning phase plan,
- decommissioning concept for period after completion of the approved phase,
- physical protection plan,
- radioactive waste management system,
- programme of environmental radiation monitoring in surroundings of the nuclear facility,
- component inspection programme,
- selected operational procedures,
- documents of personnel qualification,
- documents of insurance, or other financial security.

Decommissioning plan or decommissioning phase plan describes the initial and final state of a nuclear facility and planned activities in the given phase, including their impacts on the personnel, public and environment. The plan includes a statement that funding necessary for implementation of the activities described will be provided and that capacity of facilities for spent fuel and radioactive wastes management will be in accordance with the decommissioning strategy and schedule. The decommissioning plan or decommissioning phase plan also includes a safety analysis of potential emergencies and their consequences. The decommissioning plan or decommissioning phase plan also comprises results of monitoring of radiation conditions after shut down of the nuclear facility or after previous decommissioning phase, as well as a proposal of a radiation monitoring programme at the end of decommissioning phase.

Records of information essential for decommissioning are kept in accordance with approved quality assurance programmes for operation and decommissioning. A list of the records is shown in a conceptual plan submitted prior to the nuclear facility commissioning.

- The final decommissioning documentation includes:
- final description of the site of the decommissioned nuclear facility and all works performed during decommissioning,
- data about individual and collective effective dose and equivalent doses of personnel and public during decommissioning,
- summary data about the amount and activity of disposed or long-term stored radioactive waste and about the amount of other waste and materials released into the environment,
- list of data to be kept after the decommissioning completion with identification of the storage period,
- results of the final independent radiation monitoring.

The final decommissioning documentation presents criteria for site release and the description how the criteria were met. In the case the criteria were not fully met, the documentation presents limitations in the land use and measures taken to ensure control of the land.

G. Safety of Spent Fuel Management

G.1. General safety aspects

General safety aspects of SF management are defined in the Decree of ÚJD SR No. 190/2000 Coll. The spent fuel and radioactive wastes are handled in a way so as to:
a) minimise ionising radiation impacts on the personnel, public, and environment,
b) keep subcriticality,
c) ensure residual heat removal,
d) minimise formation of radioactive wastes.

The operator is obliged to document in the initial safety analysis report (ISAR) and in safety analysis reports submitted prior to a NF construction and prior to a NF commissioning that the requirements will be ensured.

Minimisation of RAW formation during SF management

SE-EBO quality assurance system documentation (NZK QA-RW, Directives RW 01- 04) has been developed for RAW management in all stages of the nuclear fuel cycle done at V1 and V2 NPPs of SE-EBO.

Principles, rules and technical and organisational measures for RAW minimisation at SE-EBO units 1-4 are described in the Directive RW-04.

SE-EBO adopted no less than by one order of magnitude stronger internal criterion for exclusion of leaking fuel assemblies with damaged fuel rod cladding from further reactor operation (activity of about 10^5 Bq/l in taken liquid sample from FCI casing system in SFP) as compared to the design criterion of the fuel contractor ($3{,}7.10^6$ Bq/l) in order to minimise fission products released to the primary circuit coolant from a partially burned-up leaked fuel assembly operated in the reactors of the units 1 - 4. The principles are defined in operational procedures for FCI at V1 and V2 NPPs, and in working procedures for FCI (by the “Sipping in-core test” method and subsequent “Fuel cladding test” method in the SFP).

The operator of SE-EBO V1 and V2 NPPs regularly submits reports on V1 and V2 NPP leaking fuel to ÚJD SR. Measures requested by ÚJD SR to clarify the reasons of increased fuel damage frequency at V1 NPP as compared to V2 NPP (particularly at the SE-EBO unit 2) are continuously fulfilled. The ÚJD SR measures are requested from V1 and V2 NPP operator in Inspection Protocols and Decisions.

G.2. Facilities location, siting

G.2.1 Legislation related to siting

If a nuclear facility site is concerned, the applicant shall append a territorial-decision proposal with an approval by ÚJD SR given based on an assessment of the Initial Safety Analyses Report, which includes site assessment in terms of nuclear safety (Degree of FMTIR No. 85/1976 Coll. § 7).

General basic requirements on land - technical and urbanistic solutions of nuclear power facilities are given by the Degree FM TIR No. 83/1976, § 88.

Technical specifications of nuclear power facilities are given in the Order of ČSKAE No. 4/1979 on General criteria of nuclear safety in locating facilities with a nuclear power equipment. The order defined excluding criteria of the class 1:

- excessive limit dose of ionising radiation,
- territories with seismicity of 8^0 MSK and higher,
- territories disrupted by land-slides,
- territories undermined, etc.

The criteria unambiguously exclude land use for the given purpose. Territories that come under the excluding criterion of the class 2 can be used conditionally:

- karstic territories,
- potable water resource territories,
- territories of significant altitude differences, etc.

Other criteria, such as speed and direction of ground water flows, population supply, distance of state borders, etc. are only used for comparison of sites.

A mandatory procedure of bodies, organisations, and their staff who propose, design, and implement the construction, locate and commission nuclear facilities, or their parts, in the management of RAW generated in the nuclear power facilities, was defined in the Decree of ČSKAE No. 67/1987. The above degree was replaced by the Degree of ÚJD SR No. 190/2000, which does not deal with nuclear safety requirements on nuclear facility siting. At present, ÚJD SR is preparing a degree on nuclear safety requirements on nuclear facility siting.

Design documentation of workplaces with radiation sources, in the scope necessary for assessment of all circumstances related to the personnel and environmental protection, shall be submitted to a health protection authority for approval. When making decisions on construction of plants and facilities (including the nuclear ones), which release during planned operation, or in case of an accident may release radioactive substances into the environment, impacts of the operations and accidents on the public living in the vicinity shall be evaluated. Authorities making decisions on such construction shall be provided with data on the population exposure during operation or due to an accident.
Act No. 272/1994 Coll. on the Health protection enacts the obligation of special health protection against adverse effects of ionising radiation (§ 9 item b).
Act No. 127/1994 Coll. on Environmental impact assessment deals with the procedure of a comprehensive qualified and public assessment of constructions and facilities prior to the approval decision. The assessment task is to:

- comprehensively check, describe, and assess direct and indirect environmental impacts,
- determine measures to prevent or reduce environmental damages,
- clarify and compare advantages a disadvantages with other options and with the current conditions.

G.2.2 Siting of spent fuel management facilities

The site of SE-EBO and SE- VYZ is situated in the distance of about 3.5 km from Jaslovske Bohunice in Trnava district (Western Slovakia). It is located on an elevated plain of a valley that is a continuation of eastern projections of the Small Carpathians.
The plain relief of the site is split by Maniverska valley. The site relief altitude above the sea level is 165 - 173 m, the mean value of the relief relative tilt is 1 % in south-east direction. The altitude difference in the distance of about 3 km eastwards separates the site from a plain and in this section quite wide valley of the Vah river. The Vah river flows eastwards of the site in a distance of about 8 km. There is the Bratislava brook passing between the site and Jaslovske Bohunice.
There are the following water reservoirs in the region (area of 25 to 30 km without exact distance determination):

- water reservoir Slnava on the Vah river (max. 12.3 mil. m3),
- reservoir Cerenec (0.13 - 1.35 mil. m3),

which are important in the view of NPP water supplies

- water reservoir Kralova nad Vahom (max. 51.8 mil. m3) acts indirectly as an accumulation volume in the view of dilution of discharged radioactive substances,
- other local water reservoirs, dredged reservoirs, and ponds are not linked to the NPP operation.

SE-EBO site is located in an economically strong region with a number of industrial enterprises (machine engineering, power engineering, electrical engineering, chemistry, food industry) and developed agriculture using good soil types and climate conditions.

The NF siting criteria for V1 and V2 NPPs corresponded to Soviet standards and approaches of 60's and 70's of the 20th century. The Slovak legislative criteria of a NF siting are described in detail in the Nuclear Safety National Report of Slovakia of 1998, or 2001 respectively.

The following aspects of V1 and V2 NPP siting are important in the view of SF management at V1 and V2 NPPs and related activities:

- SF is transported exclusively on railways of ŽSR (railway siding on the site of SE-EBO and SE-VYZ).
- The principle of 3-km protective zone with no permanent residence was applied during siting.
- ISFS was constructed and commissioned in 1987 on SE-EBO site, next to V1 NPP.

A seismic load of the Jaslovske Bohunice site was re-assessed (as a part of V1 and V2 NPPs and ISFS safety improvement projects) and seismic reinforcement measures at V1 NPP and ISFS were consequently implemented.
ISFS-VYZ is located inside the SE-VYZ Jaslovske Bohunice site. ISFS is designed as an independent building with no constructional link to any other building of Bohunice NPP site. In addition to ISFS, the common site contains V1 and V2 NPPs, A1 NPP in decommissioning and RAW treatment technologies.
SE-EMO site is situated in the south-west region of the Slovak Republic (Levice district, Nitra region). In the view of territorial and administrative arrangement, Mochovce NPP is located in the north-west projection of Levice district. The geological bedrock and its characteristics are acceptable in terms of safety of a nuclear power plant operation on the Mochovce site, particularly as far as characteristic of rocks are concerned that form the power plant bedrock.
The NPP is located on 7 terraces with altitude of 226 to 242 m above the sea level. Since the maximum operational level of Velke Kozmalovce Dam is at the level of 175 m above the sea level, Mochovce NPP is not endangered by flooding, or ground water respectively. Moreover, there are Vlci vrch (343 m), Velka Vapenna (350 m) and Bobove (294 m) hills located between the Mochovce NPP site and the water dam. The hills form a natural barrier preventing the Mochovce NPP site from

flooding due to failure of the Velke Kozmalovce Dam. The design considers drainage of 100, 1000 and 10000-year floods caused by rains, and defines personnel actions in case of internal flooding from technological equipment.

The original Mochovce NPP design was based on the site seismic threat knowledge from the period of Mochovce NPP preparation and designing in 80's, considering the 6th grade of MSK scale for safe reactor shut-down following an earthquake and the horizontal acceleration value PGA = 0.06 g. The legislative development presented by the document IAEA 50-SG-D15 recommends the minimum horizontal acceleration value for NPPs of 0.1 g.

Based on the above all "Classified civil structures and technological systems" were seismically re-assessed, and improvements of civil structures were step-by-step implemented. Beam supports were fitted in existing walls, light walls were reinforced with steel sections and wire mesh, and new columns to reinforce floors were fitted in some buildings. Improvement of the seismic behaviour of technological equipment includes particularly anchorage of components and reinforcement of tanks.

G.3. Designing and construction

G.3.1 Designing and construction legislation

The design documentation was developed according to the Degree No. 163/1973 Coll. on Documentation of constructions, Degree No. 105/81 on Design Documentation and the Act No. 50/1976 Coll. on Territorial planning and Building order (Construction Act).

Qualitative changes in the construction legislation occurred after 1978, when the Order of ČSKAE No. 2/1978 on Ensuring the nuclear safety in designing, approving, and implementing constructions with nuclear power facilities was approved. The order defines the basic technical requirements on nuclear safety to prevent leakage of radioactive substances into the environment.

Building structures, technological systems and components important for nuclear safety of the nuclear power facility shall be designed, manufactured, assembled, and tested in a way so as their reliable function be ensured. Manufacturers and suppliers of the classified components (components important in terms of nuclear safety), materials and accessories are obliged to present results of manufacture quality checks and tests of properties of components, systems, base material, welded joints and weld deposits, material properties and composition, as well as findings and defects rectified by the inspection (Decree of ČSKAE No. 436/1990 § 19), in the supply quality documentation. In cases when special technological procedures may influence resulting properties of materials and products used, performance of additional tests must be ensured in advance (e. g. keeping samples). The Decree of ČSKAE No. 436/1990 has been recently replaced by the Decree of ÚJD SR No. 317/2002 on Requirements on licence holder's quality systems.

Control systems must allow for monitoring, measurement, registration, and control of values and systems important in terms of nuclear safety. Instrumentation and controls shall be designed and arranged in a way so that attending personnel had enough information on operation of the nuclear power facility at any time (Order of ČSKAE No. 2/1978, § 14). The control room shall allow for a safe and reliable control of the operation. The human factor is considered only in relation to activities off the nuclear power facility.

A mandatory procedure of bodies, organisations, and their staff who propose, design, and implement the construction, locate and commission nuclear facilities, or their parts, in the management of RAW generated in the nuclear power facilities, was defined in the Decree of ČSKAE No. 67/1987. The above decree was replaced by the Degree of ÚJD SR No. 190/2000. At present, ÚJD SR is preparing a notice on nuclear safety requirements on nuclear facility designing.

Designing and construction in terms of work safety and health protection, and safety of technical equipment, including requirements on the equipment documentation, is deal with in the Decree No. 66/1989 Coll. as amended by the Decree No. 31/1991 Coll.

ISFS-VYZ

The design task for ISFS construction was approved by FMPE Protocol 41/1982 of 18 January 1983, and subsequently the construction was registered by FMTIR under reg. No. 8291982 with the designed capacity of 600 tons on 14 June 1983.

Based on the Construction permit ref. Vyst. 164/83 of 1 March 1983 and in accordance with the approved construction mode, the building site was handed over in June 1983 and the levelling works were commenced. The foundation plate was completed by the end of 1983. Subsequently the civil and electrical and mechanical part was implemented.

In 1997 ISFS refurbishment was started, which was to implement seismic reinforcement and increase the storage capacity of the original construction based on a Construction permit ref. KU-OŽP-2/03349/97/Ec-A issued on 29 October 1997.

Civil works, dismantling, assembly, and tests of components and systems were done during a continuous operation of technological systems in accordance with applicable limits and conditions, decisions of regulatory authorities, and decision of the Building Office KÚ-OŽP-2/02721/99/Ec-A of

29 March 1999, by which temporary use of the construction was approved provided that ÚJD SR would approve single stages of the active tests.
A pre-completion construction modification (monitoring of a long-term lifetime of building structures and technological systems) was approved by the Construction decision No. KÚ-OŽP-2/06417/Ec of 17 September 1999, while the final re-construction completion date remained unchanged (2007).
The design works and construction of Mochovce NPP ISFS will be governed by applicable provisions of the Slovak legislation, particularly the Acts No. 127/1994 Coll., No. 130/1998 Coll., No. 263/1999 Coll. as amended by later regulations, Act No. 50/1976 Coll. on Territorial Planning and Building Order as amended by later regulations, Degrees of ÚJD SR No. 317 Coll. and No. 318 Coll. IAEA recommendations are reasonably applied, too.

G.4. Safety assessment of components

G.4.1 General principles of safety assessment

SE-EBO:
Original Pre-operational Safety Analysis Report of V1 NPP (PoSAR)
It was developed based on technical design and data of the Russian technology contractor in 1978. SF management and safety requirements in this area was a part of the chap. 4.8: Fuel and systems for refuelling and fuel transportation. The safety requirements followed the original Russian V1 NPP design concept and were incomplete (as per internationally applicable recommendations).
<u>Innovation of the original PoSAR of V1 NPP – V1 NPP Safety Analysis Report after the gradual refurbishment</u>
The report was issued for the first time in 1998 and it was revised twice by 2002. The structure and concept of the Safety Analysis Report are described in detail in the Nuclear Safety National Report of 2001. A description of SF management is a part of the chap. 9.1 of the Safety Analysis Report: Fuel management and storage. In accordance with applicable IAEA guides and NRC RG1.70, this chapter includes:

- Principles and concept of design of components and systems for spent fuel and high-level RAW handling.
- Description of components and systems for SF management.
- Safety assessment of operation of components and systems (nuclear safety, radiation safety, technical, fire and physical protection).
- Modifications, testing and inspections of components.
- Quality assurance of the fuel cycle at V1 NPP.

<u>Original V2 NPP Safety Analysis Report</u>
It was developed in 1983 according to instructions of ČSKAE and based on technical design of V2 NPP design.
<u>Innovated V2 NPP Safety Analysis Report after 10 years of operation</u>
It was issue for the first time in 1996 and is continuously revised. The structure and concept of the Safety Analysis Report are similar to the V1 SAR after the gradual refurbishment, including the chap. 9.1: Fuel management and storage. The SAR included all innovations and works for safety enhancement in the reactor section and section of transportation and technology, including SF management during the 10-year operation of V2 NPP.

SE-EMO:
The ultimate goal of the Mochovce Nuclear Power Plant operator was to complete and operate the power plant at the level of safety that would satisfy current international requirements and standards and would be acceptable to the West-European public. Therefore a number of reviews were performed by international experts and organisations during the construction. The review results were incorporated in the design documentation and their implementation shall ensure the high level of safety and reliability of the WWER-440/V213 units.
An analysis and probabilistic safety assessment were developed for the Mochovce NPP SFP during reactor shutdown. As a part of the analysis, the following scenarios of the spent fuel pool cooling system trip were assessed:

- when a compact rack is filled up with the spent fuel,
- when both racks are filled up during emergency reactor defuelling.

ISFS-EMO
During activities related to preparation of the Mochovce NPP ISFS investment project performed so far, the following documentation has been developed and submitted to respective authorities:

- Initial Safety Analysis Report (according to the Act No. 130/1998 Coll. on the peaceful use of nuclear power).

- Plan developed according to the Act No. 127/1994 Coll. on the environmental impact assessment.

Both documents were assessed by the concerned authorities with the following results:
Initial Safety Analysis Report (ISAR): ÚJD SR provided the position on ISAR on 29 November 2001, where ÚJD SR required the report to be complemented with a RAW management preliminary plan. The document was developed and in May 2002 submitted to ÚJD SR.
Plan: The plan for the suggested Mochovce NPP ISFS construction was delivered to the Ministry of the Environment in December 2001. The plan included three variants of fuel storing in ISFS - dry variant, wet variant, and zero variant. Based on comments and assessment by various organisations and the public, the Ministry of the Environment determined the assessment scope in March 2003, based on which the Environmental impact assessment report shall be developed.

SE-VYZ:
Internal safety assessment (within Slovakia) was done during construction and commissioning of the ISFS, as well as during operation by evaluation of safety documentation by regulatory authorities and Slovak organisations (safety analysis reports, quality assurance programme, limits and conditions). Every year ISFS operational reports, including operation assessment reports, are submitted to ÚJD SR. International safety assessments of ISFS have not yet been performed.
During ISFS operation, ÚJD SR inspectors perform regular inspections focused on conditions of classified nuclear components, ISFS operational safety, and jointly with IAEA inspectors they focus on storage and accounting of nuclear materials. Any drawbacks identified by the inspectors are recorded in protocols as binding tasks that are fulfilled continuously by the operator in set deadlines.
An assessment Safety Analysis Report of ISFS was developed after 9 years of operation, which served as the basic document for a decision on increasing the storage capacity.
In 2000 in relation to ISFS refurbishment, an innovated Pre-operational Safety Analysis Report was developed, which gave an assessment of current plant conditions. The format and content of the safety analysis report was created on the basis of recommendations of the US NRC Guide No. 3.44 Standard Format and Content for the Safety Analysis Report for an Independent Interim Spent Fuel Storage (Water - Basin Type), and ÚJD SR requirements were based on the § 72 CFR Title 10 USA and IAEA Safety Series documents No. 116, 117 a 118.

G.4.2 Safety assessment of SF management system and component operation

Safety assessment of TE systems and SF management is a part of the overall operational safety assessment of SE-EBO, SE-EMO and SE-VYZ, and it is performed by:

- The operator in regular reports and assessments of nuclear safety, radiation safety, work safety and health protection, technical safety and operation of the plant, and in assessments of SF management and shipment, which are submitted to ÚJD SR, as well as in overall annual Assessments of NFC as a part of the quality system at branch companies.
- Independent scientific-research and designing-engineering organisations holding particular licences of ÚJD SR (VUJE, etc.) in operational safety analysis reports and analyses.
- Routine inspections by ÚJD SR and IAEA as a part of agreed or defined schedules at the units of SE-EBO, SE-VYZ and in SE-VYZ in inspection protocols.
- External review missions (IAEA, WANO, etc.) and their conclusions, or assessments respectively.

Detailed safety assessments of V1 and V2 NPP units are described in the National Report of Slovakia Compiled According to the Terms of the Convention on Nuclear Safety (1998 and 2001), as well as in safety analysis reports.
Once a year a report on in-service inspections, tests, and revisions (technical safety of the plant) is submitted to the National Inspectorate of Work as per the Decree No. 66/1989 Coll. as amended by the Decree No. 31/1991 Coll.

G.4.3 International expert missions for SF management

SE-EBO:
Missions completed at V1 NPP are described in detail in the National Report of Slovakia Compiled According to the Terms of the Convention on Nuclear Safety (1998 and 2001). IAEA safety assessment review mission (OSART) was performed in the field of TE operation and NFC in general at V2 NPP on 9 through 26 September 1996. The mission target was to assess operational procedures, exchange of experience and knowledge, recommendations and proposals for maintaining and improvement of the excellent performance of V2 NPP.
The level of operational documentation, organisation of activities, transportation equipment and technology conditions, nuclear fuel handling and transportation were also assessed in the field of NFC. Links and co-operation of SE-EBO departments, responsibilities and competencies of SE-EBO departments, links to SE, a. s. Headquarters and regulatory authorities were assessed in the field of NFC, too.

Conclusions of the IAEA OSART 1996 Mission for NFC at V2 NPP were the following:

- There is a lot of communication connections with support departments in the area of fuel handling.
- Thanks to a well-structured QA documentation and working documentation and thorough approach of personnel, the responsibility are not doubled and delays in NFC does not occur.
- Inspection of NF is satisfactory.
- Refurbishment is in progress at transportation equipment towards new technologies.
- Human factor impact in NUF management is minimised.
- Appropriate personnel training prior to overhaul and refuelling are performed.

IAEA OSART 1996 Mission recommendations for NFC V2 NPP

- Ensure post-radiation inspections of SF from V2 NPP reactors in SE-EBO.

Fulfilment of the IAEA recommendations at SE-EBO:

In 1997 – 1998, the process was started to procure the Loviisa NPP-type inspection pool stand from IVO, Finland (finishing with the stand supply contract approval).

In this stage, the stand procurement within SE, a. s. was delegated to SE-VYZ. In 2002 the stand modification design was approved at SE-VYZ. The stand in ISFS will serve for operative inspections of SF from V1 NPP, V1, or EMO for monitoring of conditions of the long-term stored SF in ISFS.

SE-EMO:

Since the early 90’s Mochovce NPP was subject to several international audits focused on the safety assessment with involvement of about 2000 experts, whose conclusions can be summarised in the statement that there are no safety issues, which could not be resolved and which would prevent Mochovce NPP commissioning.

- IAEA Pre-OSART Mission held on 9 through 29 January 1993, was aimed at review of the operator’s preparedness for commissioning and operation. The final report includes recommendations for improvements in the area of management, personnel training, operation and maintenance, technical support, radiation protection, emergency planning and preparedness, as well as commissioning, which affect operational safety and identify good practices and activities, which could be considered by other power plants, too.
- IAEA Mission - Mochovce NPP Safety Improvement Review was aimed at review of safety improvements at Mochovce NPP. Its goal was to discuss safety issues known to be existing at WWER-440/213 reactors, safety improvements already incorporated in the Mochovce NPP design or suggested in the Safety Improvement Report developed by EDF and SIEMENS experts jointly with Slovak companies. The review included main safety functions - power control, fuel cooling, maintaining the primary circuit integrity. In addition to that the following areas were reviewed: I&C, electrical power supply, emergency analyses, internal and external risks. The efforts were summarised in a report containing findings and recommendations for each area reviewed, which were incorporated in the Mochovce NPP safety improvement programme.
- IAEA Mission - Seismic safety review for Bohunice and Mochovce NPPs. The mission task was to review the way of seismic input data evaluation and to assess the external earthquake risk impact on the NPP safety. PoSAR under development was used as the base document. The Mission reviewed documents submitted and compared them with recommendations of the IAEA Safety Guide 50 - SG - S1, related to NPP siting. In the end procedures and results achieved were assessed as satisfactory.
- „Mochovce NPP environmental impact assessment“ by the UK company AEA TECHNOLOGY in 1994, which was a part of the „Project documentation for the public participation programme“ developed by EdF and SE, a. s.
- RISKAUDIT consortium mission (consortium of technical organisations of IPSN and GRS working for national regulatory authorities of France and Germany) aimed at Mochovce NPP safety improvement assessment and assessment of the design safety was completed on 20 December 1994.

All technical proposals, as well as organisational measures proposed in the final reports of the reviews were incorporated into the Mochovce NPP Safety Improvement Programme either directly or modified, and implemented through individual safety measures. The final report developed by RISKAUDIT in 1999 concluded the following: ”Mochovce Nuclear Power Plant is the first Soviet-design nuclear power plant completed in an East European country that achieved a safety level comparable with western standards”.

- WANO Mission conducted in November 2002 was focused on the review of operations, preparation and maintenance of Mochovce NPP. Conclusions of the mission are used for improvement of Mochovce NPP operational indicators.

As a part of an environmental audit, the aspect of refuelling and transport of the spent fuel was assessed in 2002. The audit identified no discrepancies with the standard ISO 14001 and Mochovce NPP was certified by Det Norske Veritas.

SE-VYZ:

International safety assessment of ISFS has not yet been performed.

G.5. Operation

G.5.1 Commissioning

SE-EBO:
SF handling systems form a part of a technological complex, or elementary system TC/PS 02: TE. Commissioning and tuning works of the systems must comply to contemporary legislative requirements on NPP building, commissioning, and operation in the former ČSSR (ČSFR). The requirements are described in detail in the section 3 of this report, as well as in the NS SR on Nuclear safety of 1998 and 2001. Generally the contemporary legislation for single stages of V1 and V2 NPP units commissioning required implementation and quality documentation of:

- Assembly and post-assembly individual tests of unit systems.
- Non-active tests of reactor and TE systems, including plant functional tests and hot tests of the unit with mock-up fuel assemblies.
- Active tests of the unit (including reactor and TE), i. e. nuclear fuel loading into the reactor core, Physical and power start-ups.

Original Russian contractor's documentation was supplied for all stage s of V1 NPP commissioning (programmes and schedules of the main commissioning and tuning works of single technological systems of the units 1 and 2 /functional tests/ as well as preliminary operational procedures). The documentation was adjusted to the existing conditions of V1 NPP construction and commissioning by the general designer (EGP) and the prime contractor of electrical and mechanical part (ŠKODA). In the frame of an inter-governmental agreement between ČSSR and the former USSR, Russian specialists provided technical assistance during the commissioning of the V1 and V2 NPPs.
As a part of V1 and V2 NPP commissioning, TE was tested following the tests of the reactor and auxiliary unit system according to a programme of non-active and active tests. Operational procedures for TE, reactor and units were adjusted based on the test results.
TE system and components for SF handling were tested in non-active as well as in active conditions of V2 NPP units according to the Programmes of preoperational tests (PT) and full train tests (FTT) developed by the reactor and TE contractor (ŠKODA, ZES Pilsen) and supplied by the prime contractor of electrical and mechanical part Skoda (VE Praha):

- P83: PT, FTT programme of SF storage and transportation system.
- P84: PT, FTT programme of refuelling machine.
- P85: PT, FTT programme of reactor refuelling system.
- P19: Programme of post-assembly cleaning operations of the SFP cooling system.
- P53: PT, FTT programme of the SFP cooling system.
- P68: PT, FTT programme of FCT system.

After completion of each TE system PT and FTT the "PT and FTT assessment" was developed, which documented the progress and fulfilment of determined tasks.
The construction of TE pool lining at V2 NPP was modified in EGP a SKODA design from the original simple stainless-steel lining to a double lining with leak outlet between the linings based on negative experience with tightness of simple linings at most WWER-440 units (including implementation of the pool lining at V1 NPP). PT, FTT programmes of TE (P86, P88) pool lining tightness at V2 NPP was developed by the Commissioning department of VÚJE that ensured the Scientific leadership of commissioning during tests. The approved structure of PT and FTT programmes of TE pool tightness was similar to PT and FTT programmes of TE technological part and included procedures of hydraulic testing of thermal cycle pool linings (heating up and cooling by demineralised water when the pools were filled up). The final assessment of the pool tightness testing proved 100 % tightness of the pool lining (5 mm thick inner austenitic lining, as well as 10 mm thick outer ferritic lining) at V2 NPP.
At V1 NPP, leaks of H_3BO_3 solution through the stainless-steel TE pool lining are drained by the organised leak system into the special drainage system. The volume of leaks after the facing repairs (by special procedures using steel and silicone adhesives) does not exceed design-defined values for V1 NPP.

SE-EMO:
In 1998, 1999 and 2000, tests of spent fuel handling equipment were done based on the following programmes:

- P 015 Programme of refuelling machine equipment commissioning works.
- P 017 Programme of commissioning works for replacement of absorption parts of control rod.
- P 018 Programme of refuelling equipment commissioning works.
- P 024A Programme of spent fuel storage and handling system commissioning works.P 024B Programme of commissioning works of equipment for preparation of transport container for spent fuel shipment.

Tests of single components were performed under leadership of qualified Skoda personnel. Practical training of the fuel management personnel was held at Bohunice and Dukovany NPPs (Dukovany NPP has got the same type of refuelling machine like Mochovce NPP).

SE-VYZ: Prior to completion of ISFS construction in 1987, individual preoperational and full train tests were performed at components and systems of the civil as well as electrical and mechanical part according to approved programmes. Following the successful conduct of the tests the trial operation licence was issued by ČSKAE in the Decision No. 50/87 of 26 March 1987. Based on successful performance of the trial operation test, positive decisions were given by regulatory authorities, and ISFS started operation based on the Construction approval decision ref. Výst. 235/88Va of 22 February 1988 issued by the Department of Construction of Trnava after meeting conditions specified in the Construction approval decision.

Having finished the basis part of the ISFS refurbishment, SE-VYZ applied for approval of reconstructed ISFS operation on 16 February 2000 in accordance with § 20 par. 5 and § 15 par. 2 of the Act No. 130/1998 Coll.

Use of the partially reconstructed ISFS was approved by the Construction approval decision of the Regional Office - KÚ -OŽP-2/01546/01/Ec-A on 29 January 2001.

G.5.2 Operation related legislation

Act No. 130/1998 Coll. defines conditions of approving single stages of a nuclear facility, i.e. including commissioning and operation, as well as the radioactive waster and spent fuel management. The primary responsibility for operation is borne by the operator. The law determines single responsibilities of operators for operation, emergency planning, quality assurance, nuclear safety, liability for damages, etc. fulfilment of which must be demonstrated to regulatory authorities.

ČSKAE Decree No. 6/1980 defines detailed requirements on nuclear safety during commissioning and operation of nuclear facilities.

The Decree of ÚJD SR No. 190/2000 defines requirements on RAW management equipment and on safety documentation of RAW management since the stage of designing.

According to the Atomic Act, ČSKAE Decree No. 6/1980 and ÚJD SR Degree No. 190/2000, the operator is obliged to submit the following safety documentation with the application for issuance of ÚJD SR licence for a nuclear facility commissioning:

- Safe operation limits and conditions,
- Programme of NF commissioning split to stages,
- Quality assurance programme,
- Internal emergency plan,
- Pre-operational safety analysis report,
- Physical protection plan,
- Radioactive waste and spent fuel management plan,
- Conceptual decommissioning plan,
- Programme of in-service plant inspections (components and systems),
- Selected operational procedures according to ÚJD SR requirements,
- Programmes of nuclear safety related components and systems testing,
- Documents about personnel qualification,
- Documents about nuclear facility preparedness to commissioning,
- Documents about insurance (or other financial security),
- Programme of environmental radiation monitoring around the NF,
- Preliminary RAW management plan including a description of individual RAW management activities, by which fulfilment of nuclear safety requirements in RAW management is demonstrated.

In addition to ÚJD SR, there are also other state authorities involved in the licensing process (see also chapter E):

- Ministry of Health – for radiation protection
- Ministry of Interior – for safety, physical protection, and public protection
- Ministry of Environment – environmental impacts
- National Inspectorate of Work – work safety and health protection, and safety of technical equipment (work inspection)
- Bodies of regional state administration in charge of issuance of a construction and plant use decision

Operation licence for a nuclear facility is issued by ÚJD SR after submission of the operator's application appended with a report about the nuclear facility commissioning assessment. The operator is obliged to follow the assessed and approved documentation during commissioning and operation. Any deviations from the documentation are possible only based on a prior approval of ÚJD SR.

The operator's activities are governed by IAEA safety standards, such as the regulations SC 50-C-O „Nuclear power plant operational safety", SC 50-C-QA „Quality assurance at nuclear power plants",

and related guides and the regulations SS No. 111-F „The principles of Radioactive Waste Management“, SS 11-S-2 „Establishing a National system for Radioactive Waste Management“, SS 111-G1.1 „Classification of Radioactive Waste“.
The nuclear safety concept of nuclear power plants is based on the „defence-in-depth strategy“, which is generally used all over the world during nuclear power plant designing and operation. When evaluating the NF safety, ÚJD SR assesses the plant’s ability to fulfil safety functions in accordance with the design so that required “defence-in-depth” level was ensured.

G.5.3 Limits and conditions for SF management

Limits and conditions of a safe operation *is one of* the basic documents used at a nuclear power plant, or other nuclear power facility. The regulation has been developed based on ÚJD SR requirements, according to the Act No. 130/1998 Coll. for Ensuring the nuclear safety, where the constructor company shall:

- Submit the L&C proposal prior to issuance of ÚJD SR approval for a NI construction
- Ensure approval of the L&C by ÚJD SR in the stage of a NI commissioning
- Meet L&C, while ÚJD SR is in charge of inspecting the adherence.
-

SE-EBO:
In 1995 through 1998, L&C for operation of the V1 NPP units were amended and incorporated into separate documents for units 1 to 4 of SE-EBO. The L&C contained the following limit conditions for operation of TE equipment:

- Water level, H_3BO_3 concentration for SFP cooling,
- Transportation means – refuelling machine, reactor hall cranes,
- IAEA supervision instrumentation in the reactor hall,
- Communication connection during refuelling in the reactor,

Reporting of operational events and communication records.
In the next amendment of L&C of units 1 through 4 in 2002, the limit conditions were omitted from L&C and moved (in the original wording) to particular TE operational procedures, where they are presented as technological and organisational instructions for TE operation and NUF (SF) handling.
The modification was done based on a concept adopted by SE-EBO and approved by ÚJD SR according to US NRC NUREG 1431, which defines more strict criteria for specification of L&C than the original ones adopted by ČSKAE and ÚJD SR.
Technological procedures, rules and instructions for TE and nuclear fuel handling determine technical and organisational measures to ensure all technological instructions, commands, bans, and restrictions of the original L&C for V1 and V2 NPPs.

SE-EMO:
Limits and conditions were developed for operation of Mochovce NPP and transportation technology equipment *(1LP/1001, 2LP/1001)* and the following limit conditions were defined:
For SFP:

- Water level in the spent fuel and refuelling pools (sufficient water layer shall be ensured to protect personnel against radiation from fuel)
- Concentration of H_3BO_3 in the storage pool (sub-criticality in the spent fuel pool)
- Storage pool water cooling (removal of residual heat generation from the SF).

For means of transportation:

- Refuelling machine (handling with fuel assemblies and control rods according to technical conditions and safety requirements)
- Crane (prevents from drop of foreign objects into the area of the reactor vessel, spent fuel pool, and transportation container pool)

For IAEA supervision equipment:

- System of IAEA supervisory equipment in the reactor hall (documentation of nuclear fuel handling manipulations in the reactor hall and in the spent fuel pool).

SE-VYZ:
Subcriticality of systems is given by the structure and material composition of licensed bakets T-12, T-13, KZ-48, spent fuel pools, and technological systems of the transportation equipment. Residual heat removal is provided by the pool water cooling and cleaning system.
Limits and conditions are applied to ISFS operation (A-02/ISFS).

G.5.4 Regulatory and working documentation for NFC operation, maintenance and care about transportation equipment

SE-EBO:
SF management at V1 and V2 NPP units is a part of the nuclear fuel cycle for which particular QA documentation and its subservient documentation was developed at SE-EBO. The complete regulatory and operational documentation binding for technical administrative as well as shift attendance posts of NUF administration and management of SE-EBO V1 and V2 NPPs (section of special activities, department of fuel management) is kept at all main NUF management workplaces at V1 and V2 NPP (fresh fuel storage in the reactor hall). The scope of the documentation is shown in the approved „Workplace documentation lists“ of V1 and V2 NPPs for single job-posts. The basic SF handling with nuclear safety implications is performed by technical and attendance personnel of V1 and V2 NPPs, in accordance with the following documentation:

a) Regulatory documentation of SE-EBO quality assurance:
   - NZK QA-NF: Quality assurance standard „Fuel cycle“
   - Directive NF-02: NUF monitoring in the reactor core
   - Directive NF-04: Nuclear material accountancy
   - Directive NF-06: NUF handling, transportation, and storage at SE-EBO
b) Technological operational procedures (for TE) of V1 and V2 NPPs (TOP):
   - 0-TOP-152: SF transportation from V1 and V2 NPP reactor buildings to ISFS
   - TOP V1 NPP: 5-TOP-111: Storage and transportation of SF, handling with high-level RAW
   - 5-TOP-153: Refuelling machine
   - 5-TOP-184: Inspection of fuel rod cladding tightness
c) TOP V2 NPP:
   - 6-TOP-151: SF Storage and transportation of SF, handling with high-level RAW
   - 6- TOP-153 – Refuelling machine
   - 6-TOP-138: Inspection of fuel rod cladding tightness

Reviews, revisions, maintenance, tests, and comprehensive care about SF handling equipment are performed according to instructions developed for the entire TE, as well as for single systems and components. Personnel obligations, responsibilities and competencies are defined in job-post descriptions. In additions to the above operational documentation, personnel is obliged to follow the safety (L&C, rules, orders, etc.) and regulatory QA documentation (guidelines for NFC, operation and safety). SE-EBO regulatory and operational documentation structure is described in detail in the NR SR on nuclear safety of 1998 and 2001. According to ÚJD SR classification all regulatory, technical administrative, and attendance posts in SF management belong to the category of personnel with impact on nuclear safety, for whom internship and on-the-job training programmes shall be developed (by „SAT“ methodology). Having passed the basic training and exams at the authorised organisation (VÚJE Training centre) and at a V1 or V2 NPP workplace, the staff members will receive the „Authorisation for performance of works with impact on nuclear safety“.

SE-EMO:
All manipulations at the transportation technology equipment are performed based on the following technological procedures (TP), manipulation cards (MC) and QA system documentation:

- QA13-03 Handling, storage and shipment of spent fuel
- TP/1036 Spent fuel storage and shipment
- TP/1037 For reactor refuelling
- TP/1039 For refuelling machine
- TP/1041 For FCIT system
- MK/1003 Fuel cladding inspection system
- MK/1004 Equipment for refuelling and fuel shipment
- 2MK/1004.2 Equipment for refuelling and fuel shipment – Annex: Diagrams and tables for the unit 2

TP describe technical parameters of equipment and equipment instruction manual. MC define procedures of single operations.

SE-VYZ:
Safety requirements are incorporated in particular operational documentation based on successfully passed plant exams. All operations in the ISFS nuclear facility are performed in accordance with the quality documentation and operational procedures, e.g.:

- VYZ/ZSM-53 Nuclear fuel cycle
- VYZ/ZSM-53.01 Handling, transportation and storage of WWER-440 SF
- VYZ/ZSM-53.02 Accountancy and inspection of nuclear materials at SE-VYZ, etc.

System of pool water cooling and cleaning is operated on a periodical basis and with no problems in accordance with applicable operational procedures and particular limits and conditions. Parameters of pool water quality and cleanliness are regularly monitored on a weekly basis.

During a long-term operation, micro-organisms are created in the water, originating from organic substances in the water. The biological pollution of water is regularly monitored and assessed for presence of biological micro-organisms (mesophyllic bacteria, sporolytic bacteria, yeasts, fibrous fungus).

ISFS radiation protection is ensured by the measurement system of aerosols, dose-rates, cooling water activity, and individual dosimetric monitoring.

Environmental radiation protection is ensured by radioactivity measurement of aerosol radioactivity at isokinetic piping sampling from the venting stack.

ISFS radiation situation is stable, and corresponds to the character of technological system standard operation. No radiation event occurred. No staff member received the IDE exceeding the maximum allowed dose values given by the ALARA system and the Act No. 272/1994 Coll.

In 1987, spent fuel assemblies started to be loaded in ISFS. The fuel is transported from WWER-440 units by on-site and off-site transportation using 3 transportation containers of C-30 type and special railway wagons of Uaais series.

In the period of 1989 through 1992, SF from Dukovany NPP, Czech Republic, was transported to ISFS. There were 11 transports in total. Since 1995, the SF started to be transported back to a newly-built Dukovany dry storage. The total of 14 off-site transports from ISFS to Dukovany interim storage were done.

At present, there are on-site transports from SE-EBO units to ISFS performed. Each transport is assessed in a separate report and submitted to regulatory authorities. Required tests of inspected equipment and defectoscopic inspection of railway wagons are done on the regular basis.

Based on the in-service inspection results, monitoring system results, and 16-year operational experience it can be concluded that all ISFS operational parameters are fully in compliance with the limit conditions and requirements of regulatory authorities, as well as ISFS internal regulations. ISFS operation is safe and reliable.

G.5.5 Operation technical support

Organisational units of the operator include technical support and safety departments, which are aimed at:

- organisation of measures to protect health of the personnel and public living in the NPP vicinity against the ionising radiation by applying the ALARA principle at work with ionising radiation,
- organisation of off-site and on-site radiation monitoring, personal dosimetric monitoring and surveillance of adherence to radiation safety rules,
- development of design documentation to the stage of investment request in the areas of:
- improvement of operational safety, reliability, and effectiveness,
- ensuring design of nuclear facility modifications, control and co-ordination of the residual lifetime assessment programme,
- organisation of operational procedure development for normal and emergency operation, as well as other operational documentation and its permanent updating,
- surveillance of adherence to nuclear safety rules during operation, and assessment of all design modifications of components and operational modes in terms of nuclear safety,
- organisation of nuclear facility event analyses, development of analyses, and overall organisation of feed-back at own and foreign nuclear facilities,
- probabilistic safety assessment (PSA) and its application,
- determination of the programme of periodical testing of components and systems important in terms of nuclear safety,
- accountancy of nuclear materials, calculations of fuel loading, and fuel cycle strategy, surveillance of nuclear safety during refuelling, and physical start-up,
- organisation and ensuring of safety emergency analyses,
- management of technically oriented international co-operation projects (PHARE projects, etc.),
- ensuring of fire protection,
- organisation and co-ordination of liaison with national regulatory authorities in the area of nuclear and technical safety,
- management and organisation of the entire emergency planning.

In ensuring the above activities, the operator co-operates with external support organisations, such as:

- various research institutes, designing and analytic organisations - VÚJE, RELKO s. r. o. Bratislava,
- Slovak Hydrometeorological Institute,
- universities,
- Slovak Academy of Sciences,

- commercial contractor organisations from Slovakia, as well as from abroad - ÚJV Řěž a. s., AllDeco, AEA-Technology, Nukem-Tessag, Slovria s. r. o., SGN, etc.

„Nuclear Safety Boards“ are advisory bodies of the operator’s branch company managements. The task of the Boards is to assess and propose solutions of comprehensive safety issues of nuclear installations.

G.5.6 Analysis of operational events

Event analyses at SE-EBO, SE-EMO and SE-VYZ are controlled based on internal regulations of the quality assurance system. Each failure occurring at a plant is registered and systematically reviewed by the technical support division. At the Failure Committee meetings the Committee defines further procedure to rectify the failure, personnel informing, and event reporting to ÚJD SR according to specified rules.

The whole process related to the nuclear event investigation, reporting, analysing, filing and taking of corrective measures is performed by a feed-back group that in terms of organisation belongs to nuclear safety sections of NPPs. Training of the feed-back group personnel on the use of HPES methodology introduced by INPO, USA, was organised by Nuclear Electric company, UK, and retraining was organised within PHARE project by Spanish companies Union Fenosa and Tecnatom.

In 2000, the Decree of ÚJD SR No. 31/2000 Coll. on Nuclear facility events came in force. The Decree enacts a detailed modification of event classification (failures, incidents, accidents) based on the Act No. 130/1998 Coll. Furthermore, the degree specifies the manner of event notification, identification of causes, as well as public informing.

Linked to the Decree No. 31/2000 Coll. the operator adjusted the entire process of event notification and solution (described in the NR SR September 1998) and internal regulations on the nuclear installation event feed-back.

INES 0 and INES 3 events occurred in the SE’s SF management so far.

Reporting and investigation of events in terms of work safety and health protection, and technical equipment safety is also ensured as per the Decree No. 111/1975 Coll. as amended by the Deree No. 483/1990 Coll.

G.6. SF disposal

Development of a deep geological repository (DGR) for permanent disposal of SF and high-level RAW started to be dealt with systematically step-by-step in 1996. Two stages of DGR development were completed in the period of 1996 through 2001. The following tasks were dealt with during the completed stages:

- Design and implementation activities,
- Source term, near and far interactions,
- Site selection
- Safety analyses,
- Public involvement.

There were 5 candidate sites selected in the process of the step-by-step assessment during the period, where the basic field research was performed. In addition to that, partial reports summarised international experience in the deep geological repository development, directions and plans in all areas were set, expert teams for solution of individual issues was established, and co-operation started with organisations dealing with deep geological disposal in Belgium, Switzerland, Czech Republic, and Hungary was established.

Recently, tasks were set to continue in the DGR development. The tasks are linked to the two already completed stages. The crucial moments in the forthcoming period, which will have an essential influence on further DGR development in Slovakia, will be the changes related to the restructuring of the power industry and adoption of the national concept of SF and RAW management.

It is suggested to continue in the DGR development with the following three tasks in the period of 2003 through 2007:

- Site selection,
- Demonstration of DGR safety,
- Technical and organisational activities and co-ordination.

The purpose of this stage shall be a reduction of the number of study sites, and to shift from the level of study sites to prospective sites.

Results of works to be done in 2008 through 2012 (2015) shall demonstrate all necessary conditions of the DGR preparation and implementation. The most important aspect of the above is the DGR location, including its public acceptance. The next stages of the DGR development shall then be the following:

- preparatory stage, rezulting in the construction approval,
- implementation stage, rezulting in DGR operation.

H. Safety of Radioactive Waste Management

H.1. General safety requirements

H.1.1 Sub criticality and removal of residual heat

For management of low and intermediate level RAW, sub criticality and heat removal do not represent specific problem.

For RAW are valid the same requirements as for SF (G.1.) established in the Decree ÚJD No. 190/2000 Coll. Before this regulation were issued, requirement on RAW sub criticality and heat removal was not listed in legislation, but in relevant cases was sub criticality evaluated within the frame of safety documentation (for example removal of chrompik and sludge from SF A1 casks into new tanks within SF preparation for transportation into Russian Federation).

H.1.2 Program of minimization of RAW production

Requirement on minimization of RAW production is stated in the ÚJD Decree No. 190/2000 Coll. (see also G.1) and was stated also in previous ČSKAE regulation No. 67/87 Coll.

To establish and implement system in the area of RAW production minimization in SE, a. s. was the highest priority at establishing of QA-system. System of minimization is elaborated in the Bohunice nuclear power plant in the directive RW-04 „Minimization of RAW production“ and in Mochovce nuclear power plant in the document QA14-03 „Minimization of radioactive waste “.

Besides exploitation of own mechanisms were EBO obliged by the protocol ÚJD SR No. 73/2000 „to elaborate program for minimization of RAW production for period of years 2001-2005 and introduce inspection mechanism of the program fulfilment and evaluation“. As a fulfilment of this task were worked out programs of minimization of RAW production for each NPP individually and their evaluation is checked in the „Report on RAW management in SE EBO“.

For SE-EMO resulted such task from the ÚJD SR Protocol No. 128/2001. Program of RAW minimization to the year 2010 is now elaborated.

Within the realization of these programs the significant decrease of RAW production occurred.

Legislative (amendment of act 272/1994 Coll. from the year 1996 – metallic materials, Decree of MoH SR No. 12/2001 – all materials) and technical conditions were gradually created for release of materials to the environment.

H.1.3 Connections between RAW management facilities

A part of the documents “Preliminary plan of RAW management” and “System of RAW management”, which are submitted by operator and reviewed by ÚJD before construction and operation of RAW management facilities, are also descriptions and analyses of RAW streams containing the following activities:

- storage of untreated RAW,
- treatment of RAW,
- storage of intermediate products ,
- shipment between individual steps,
- conditioning of RAW,
- disposal of RAW.

Before start of RAW processing the characterization of physically-chemical and radiochemical properties of actual sort (type) of RAW is necessary, which is indicated in RAW check- list (required by ÚJD SR Decree No. 190/2000), which is transmitted together with RAW at individual steps within RAW management.

Safety requirements on individual activities are listed in the ÚJD Decree No. 190/2000 Coll.

Before commissioning and during operation, operating procedures are elaborated and improved (see H.6.3), which take into account relations between individual steps of RAW management. Transfer of RAW within SE, a. s. between branches is also solved by operating procedures and contractually established.

Before issue of Atomic Act No. 130/1998 Coll. description of RAW management was a part of safety report, but independent document taking into account relations between individual activities was not required from the operator. ÚJD by Decision 4/96 required to describe flows of liquid, solid and gaseous RAW and evaluate their importance from the point of view of amount of activities, from their production to the final conditioning and to describe accepted and planned measures for minimization of total activity and volume of RAW. On the basis of this requirement SE-EBO elaborated individually for both NPP documents “RAW management”, which evaluated system of RAW management and its compliance with requirements of ČSKAE Regulation No. 67/1987 (substituted by ÚJD Decree No. 190/2000 Coll.) and IAEA recommendations listed in Safety Series No111-F „The principles of Radioactive Waste Management“, Safety Series 11-S-2 „Establishing a National system for Radioactive Waste Management“, Safety Series 111-G1.1 „Classification of Radioactive Waste“. Measures on minimization of RAW production and improvement of system of RAW management in EBO were determined.

H.1.4 Assurance of effective protection of individuals, society and the environment

Assessment of NPP influence on individuals, society and the environment and requirement on its minimization is established in the National Council Act No. 127/1994 Coll. as amended, on Environmental impact assessment.

Radiation protection of personnel, public and environment was evaluated for each NPP within initial, preliminary and pre-operational safety analysis report or within conceptual decommissioning plans and decommissioning plan on specific phase since the year 1976, when was safety documentation the first time required by Act No. 50/1976 Coll. on civil structures. Requirements on safety documentation were specified in details in ČSKAE Decrees No. 2/1978 Coll., No. 4/1979 Coll., No. 6/1980 and No. 8/1981 Coll.

At the present time the requirements on contents of safety documentation are stated in the Atomic Act No. 130/1998 Coll. including relevant regulations. Requirements on the content of documentation for radiation protection are established in the act No. 272/1994 Coll. on Public Health as amended in the year 2000.

Operational monitoring and monitoring of the environment in the vicinity of radwaste repository. The aim of monitoring of repository and its vicinity is to prove, that during disposal of radioactive waste, and/or after closure of the repository, its ability to separate safely RAW from the environment is maintained. The system of monitoring will provide information important for reviewing and evaluation of repository safety during operation and also after end of operation. The ”Project of NRR monitoring” was worked out, which is divided into 9 main parts - monitoring of drainage waters (under the waults the drainage is checked and watched), underground and surface waters (in the site of NRR and in its close vicinity the 53 monitoring drill holes are situated, as well as 6 lysimeter probes and two measuring overflows on surface streams), atmosphere, soil, food chains, humidity of clay layer, influence of erosion on the repository site, structures of repository from armoured concrete and monitoring of stability of the repository. Annually about 800 samples is taken for radiochemical analysis, where waters as well as soil, sediments, atmosphere and food chains are analysed.

H.1.5 Biological, chemical and other hazards

Safety documentation for RAW management in compliance with legal regulations (ÚJD SR Decree No. 190/2000 Coll.) takes into consideration besides radioactivity also physical, chemical and biological properties of RAW as toxicity, flammability, explosibility and other dangerous properties, which could influence safety of RAW management. Contents of these substances in RAW is limited within “Technical Specifications” of each facility.

H.1.6 Limitation of influence on future generations and their inadequate loading

The main stimulus for final disposal of radioactive wastes is internationally accepted principle do not load excessively future generations with consequences of our activities. Future generations have right on the same level of protection as present generation. Therefor requirement to evaluate (act No. 127/1994 Coll.) and to prove (act No. 130/1998 Coll. and No. 272/1994), that waste disposed into repository never cause radiation exposure of population higher, than it is acceptable in the present, was established. Analyses of long-term safety of the repository (assessments of functionality of repository) in the individual stages of the safety reports were provided.

H.2. Existing facilities and past practices

Facilities at their commissioning fulfilled the safety requirements established in the valid legislation. Facilities were gradually harmonized with increasing requirements according to legislative conditions. ČSKAE Decree No. 67/1987 Coll. which stated safety requirements on storage of RAW, allows their implementation within five years. Decree No. 190/2000 Coll. requires checklist of RAW and rigorous evidence of recent RAW. For RAW produced before the year 2000 the records are gradually completed in electronic form partially on the base of written records, or in case of “historical wastes” these are withdrawn, separated and characterized according to the requirements on check- list.

H.3. Siting of proposed facilities

H.3.1 Legislative requirements

Assessment of NF influence on individuals, society and the environment and request on its minimization is required by the **Act of NR SR No. 127/1994 Coll.** on Environmental impact assessment as amended**,** In accordance with this act the operator is obliged to submit Environmental Impact Statement (EIS) and Environmental Impact Assessment (EIA) for each nuclear facility and compare the impact of alternatives of its siting or technical solution including impact to existing facilities located in the vicinity. Process of reviewing of above-mentioned documentation includes information of concerned public (public hearing) and allows to civil initiatives and associations involvement in the assessment.

No new nuclear facility for RAW management was sited after the year 1994 with the exception of integral storage (SE-VYZ). For this facility the EIS was issued and EIA is under preparation.

In accordance with this act there were evaluated activities planned for decommissioning of A1: (period 1994-99 -withdrawal of historical waste, 1. phase of decommissioning and decommissioning options after the end of the 1. phase.

Process of siting of repository for high level waste (eventually for spent fuel) is in the stage of preparation and only general geological survey was performed (SE, a. s.).

Site SE-EBO and SE- VYZ is used for new technologies for treatment and conditioning including storage. The rooms of NPP A1 after dismantling of original technological equipment are also used for these purposes in the Bohunice site. are used

Safety documentation (Initial safety analysis report) for siting of each NF before the Act No. 127/1994 Coll. came into force, involved on the basis of acts No. 50/1976 Coll. and 28/1984 Coll. and ČSKAE decree No. 4/1979 Coll. assessment of NPP radiological impact on personnel and public (individuals and society). Licensing for construction according to the Act No. 50/1976 Coll. allowed involvement of concerned municipalities and thereby also involvement of representatives of other facilities located in the vicinity of the nuclear facility.

H.3.2 Siting of individual NF

Siting of NPP in the sites Bohunice and Mochovce (see also G.3.)

Criteria for siting of nuclear facilities for older units WWER-440/230 (V1) responded to soviet standards and approaches, where the most important criterion was radiation protection of population (corresponding with international approach in the fifties). At siting the principle of three kilometres protective zone without permanent settlement was used.

In the time of siting, design and construction of SE-EBO was applied Czechoslovak standard „Seismic load of structures“. These standards calculated with earthquake with probability ones for two hundred years and with value of earthquake intensity 6,4^{o} MCS in the area of Jaslovské Bohunice. Revaluation of seismic load of locality Jaslovské Bohunice was included to projects for increase of safety of SE-EBO units.

In 09/79 were issued documents for siting in the MOCHOVCE site, in terms of at that time valid legislation. On the basis of IAEA 50-SG-D15 recommendations were within the program of safety increase of SE-EMO units seismically revaluated „Selected buildings, objects and technological systems“.

Siting of NRR (near surface repository)

Selection of locality suitable for construction of repository took place in the years 1975 – 1978. Criteria for site selection were specified on the basis of current valid legislation and safety guides of IAEA.

Attention was given first of all to requirements on suitable geological and hydrogeological conditions at the selected site, because from the safety analyses of disposal facilities operated in the world clearly results, that the critical way for exposure of population is transfer of radioactive substances by underground water. On the Slovak Republic territory were evaluated 34 sites, from which 12 were chosen for further observation. Of these was on the basis of selection procedures chosen the locality Mochovce.

During the process of repository siting, the principle was accepted, that no site can be approved earlier than the problem of mutual interaction of the locality and the repository will be solved in such a way, that the radiological consequences of this interaction would be acceptable for public and for environment.

Several phases of engineering geological survey were performed during siting and construction of NRR. (see also H.3.1)

Evaluation of site and repository safety after its closure

Evaluation of repository safety after its closure is a part of analysis of the repository long-term safety, which constitutes a principal part of safety reports. Initial (1981) and preliminary (1984) safety analysis report evaluated long term safety of repository for disposal of operating waste from NPP of WWER type.

Evaluation of facility impact on individuals, society and the environment (see also H.1.4, H.3.1)
Initial safety analysis report was issued for all nuclear facilities located on the Slovak Republic territory with exception of NPP A1, which was commissioned before the above mentioned acts and decree were put into the force. Some of nuclear facilities for RAW management (facilities SE- VYZ with exception of repository, facilities of VÚJE) are located in the Bohunice site (originally SE-EBO site), siting and licensing process for construction were merged. Basis for this process was evaluation of preliminary safety analysis report for each individual facility, which contained detailed assessment of radiological impact on individuals and society for the concrete technical solution and nuclear facility siting.

Information of public and contracting parties around the facility on safety of facility (see H.1.4, H.3.1)

H.4 Design and construction of facilities

(see also G4)

H.4.1 Legal basis

Licensing processor construction of facilities is performed in a way that is described in the part E.2. in compliance with requirements of the Act No. 50/1976 Coll., ČSKAE decree No. 2/1978 Coll. and the Act No. 130/1998 Coll. (before its issue according to the Act No. 28/1984 Coll.)

ÚJD issues approval on construction of nuclear facility on the base of written application of the operator with the following safety documentation, which confirms fulfilment of safety requirements:

a) preliminary safety report,
b) design basis,
c) preliminary plan of management of radioactive wastes and if appropriate of spent fuel,
d) conceptual decommissioning plan,
e) classification of classified equipments by safety classes
f) preliminary physical protection plan,
g) quality assurance program for construction,
h) preliminary on-site emergency plan,
i) proposal of technical specifications for safe operation,
j) preliminary program of pre-operational inspection of NI,
k) preliminary program of pre-operational radiation monitoring of the environment in vicinity of the nuclear facility.

Minimization of radiological impact is established in the Act No. 272/1994 Coll. and is proved by documentation submitted according to amendment of this act from the year 2000 (see E.3.2). Before the year 2000 common safety documentation required by the Act 130/1998 Coll. or by the Act 28/1984 Coll. and ČSKAE decree 2/1978 Coll. was submitted to the both regulatory bodies. Proposal of technical specifications contains justification of discharge limits.

Conceptual decommissioning plan as a part of documentation submitted before the start of construction are required only from the issue of the Act No. 130/1998 Coll. There contain, in compliance with ÚJD SR Decree No. 318/2002 brief description of technical solution of decommissioning, by at least two options, including estimation of financial costs, expected radiation situation and amount and activity of RAW from the decommissioning as well as estimation of capacities of waste management technologies.

Till the year 2000, conceptual decommissioning plans for all nuclear facilities were submitted by the operators and reviewed by ÚJD.

Technical measures for closure of repository and their description are the part of preliminary safety report of the repository.

Requirements on safety of nuclear facilities are stated in the ČSKAE decree No. 2/1978 Coll. on nuclear safety assurance at design, permission and performance of constructions with nuclear power facilities. For the individual facilities for RAW management these requirements were accordingly applied, included into design and their fulfilment was confirmed in the relevant preliminary safety reports.

H.5. Assessment of safety of facilities

Requirements for safe management of RAW from nuclear facilities were issued by the Act No. 130/1998 (Atomic act)) and by ÚJD SR Decrees No. 190/2000 and No. 284/1999.

H.5.1 Safety assessment before the construction

Safety assessment of NF before their construction is performed on the base of reviewing and approval of safety documentation (see H.4.), contents of which is determined by the ÚJD degree No. 318/2002 Coll. This documentation or documentation according to the Act No. 28/1984 Coll. (which was substituted by the Act No. 130/1998 Coll.) was issued for all nuclear facilities in the Slovak Republic with the exception of NPP A1. For RAW management facilities, which are the part of NPP A1 and NI „Technologies for treatment and conditioning of RAW“, were issued preliminary safety reports, gradually for each individual technology.
Requirements on occupational health and safety at work and safety of technical equipment are solved by the Act No. 330/1996 Coll. as amended, decree No. 718/2002 Coll., decree No. 66/1989 Coll. as amended by the decree No. 31/1991 Coll.

H.5.2 Safety assessment for the period after closure of repository

The first version of pre-operational safety analysis report was submitted to the ČSKAE in the year 1991. ČSKAE required to amend safety analyses and justified “Technical specifications”. The second version of pre-operational safety analysis report was issued in compliance with NUREG 1199 in co-operation with experts from SCK-CEN Mol, Belgium. Some waste from NPP A1 were also included to the long-term safety analyses, the report was submitted to the ÚJD in the year 1993. WATRP mission of IAEA in the year 1994 recommended some modifications of the repository including drainage system and completion of pre-operational safety analysis report by additional safety analyses of scenarios and by determination of duration of institutional control. Safety documentation was also supplemented by documentation of quality assurance and was submitted to the ÚJD SR in the year 1998. Supplementary safety analyses used to be issued for new waste packaged. Advanced computer models and programs are applied.

In actual pre-operational safety analysis report are listed the basic information about operator including organizational structure, description of purpose and scope of facility () and submitted basic information, by which the operator document its organizational and technical preparedness to operate the near surface repository. PoSAR confirms that during the operation and also in the period of institutional controls are individuals, society and the environment protected against radiation accidents. PoSAR confirms, that in case of compliance of conditions stated in the report, overrun of criteria specified for the repository by the Ministry of Health of the Slovak Republic will not occur:

1. effective dose for individual from the population as a consequence of evolution scenario (scenarios with probability, which will with time approaches one) must not exceed 0.1 mSv/year in any year after the end of institutional control of the repository.
2. effective dose for individual from the population as a consequence of intruder scenario (scenarios, probability of which will be considerably less than one) must not exceed 1 mSv/year in any year after the end of institutional control of the repository.

PoSAR contains following parts devoted to safety assessment during the period after closure of repository:

a) Plan of the repository closure and institutional control (on the level of feasibility study)
   - Site stabilization
   - End of repository operation
   - Post-operational monitoring
b) Safety analyses
   - Characterization of disposed waste
   - Safety aspects of the repository operation
   - Long-term stability
   - Analyses of the long-term repository safety
   - Waste acceptance criteria as a result of safety analyses

H.5.3 Safety assessment before commissioning and during operation

H.5.3.1 Waste management technologies at Bohunice and Mochovce sites

Assessment before the operation

Licensing process before NF commissioning and operation is performed on the basis of reviewing and approval of safety documentation (see H.6.), contents of which is determined by the ÚJD Decree No. 318/2002 Coll. This documentation or documentation according to the Act No. 28/1984 Coll. (which was substituted by the Act No. 130/1998 Coll.) was issued for all nuclear facilities with exception of NPP A1.
Assessment before the operation of NPP V1, NPP V2 and NPP Mochovce see also G.5

For RAW management facilities, which are a part of NPP A1 and NI„Technologies for treatment and conditioning of RAW“, were pre-operational safety analysis reports issued gradually for each individual facility so as they were prepared for commissioning.

Assessment during the operation

In the year 1996 was, within the periodical assessment, issued Safety report of the NPP V2 and in the year 1998 Safety report of NPP V1, which evaluate RAW management in the four chapters:

- source terms
- liquid waste management
- gaseous waste management
- solid waste management

H.6. Operation of facilities

H.6.1 Commissioning and operation of facilities

Approval for commissioning of nuclear facility is issued by ÚJD in compliance with the Act No. 30/1998 Coll., ČSKAE Decree No. 6/1980 and the ÚJD degree No. 318/2002 Coll. after submission of operator's application accompanied by the safety documentation, which is submitted as follows:

a) for approval:
   1. technical specifications of safe operation,
   2. nuclear facility commissioning program split into phases,
   3. quality assurance program,
   4. on-site emergency plan,

b) for review:
   1. pre-operational safety analysis report,
   2. plan of physical protection,
   3. system of management of radioactive wastes and spent fuel,
   4. conceptual decommissioning plan,
   5. program of in-service inspection (components and systems),
   6. selected operating procedures,
   7. test programs equipments and systems important to nuclear safety,
   8. evidence of special qualification of employees,
   9. evidence of readiness of nuclear facility for commissioning,
   10. evidence documents on insurance or other financial cover,
   11. program of radiation monitoring of the environment in the vicinity of nuclear facility.

Issue of approval for operation is based on evaluation of reports for individual phases of NF commissioning and document about readiness of nuclear facility and employees for permanent operation.

All NFs for RAW management have valid approval of ÚJD on their operation, issued under above mentioned conditions (see also G.4)

Licensing process for NRR operation

In compliance with legislation, NRR Mochovce was under commissioning on the basis of the Permit of Regional Authority in Nitra (Permit for Temporary Use of facility for the active test) in compliance with the § 84 of the Act No. 50/1976 Coll. This permit was issued by KÚ Nitra on 10. 12. 1999 on the basis of positive decision of:

- County hygienist
- Chief hygienist of Slovakia
- NLI SR
- ÚJD SR

ÚJD SR issued by decision No. 335/99 from the date 25.10.1999, in accordance with the Act No. 130/1998 Coll. approval for commissioning of NRR Mochovce.

Commissioning of NRR was performed in compliance with mentioned decision during the period from 14. 6. 2000 till 13. 6. 2001 and was evaluated in the "Report on Assessment of Commissioning of National Radwaste Repository Mochovce", which was submitted to ÚJD SR on 14. 6. 2001 in accordance with §15 par. 3 of the Act No. 130/1998 Coll.

On the basis of application and Report on Evaluation of Commissioning of NF National Radwaste Repository Mochovce, ÚJD SR issued the approval for operation of NRR by the Decision No. 172/2001.

After evaluation of the active test operation and after successful final inspection the KÚ in Nitra has issued on 22. 11. 2001 under the No. 2001/08859-006 Certificate of Practical Completion, by which was permitted the use of NRR Mochovce.

H.6.2 Technical Specifications (TC)

for all nuclear facilities exist, format and contents of which follows IAEA and US NRC guides. At each technical specification is stated:

- aim of the limit,
- detailed description,
- validity of the technical specification
- activity of operating personnel in case, that the criterion is not met,
- requirements on inspection - determine frequency, type and extent of inspections and tests of systems and equipments.

TC on NPP with WWER

TC for operation were already required by the former ČSKAE as a part of Safety Report. For the units of V1 TC were issued before commissioning in the year 1978, and their independent review was performed by different research institutes, among others also VÚJE. In the half of eighties were TC for the units WWER-440/230 revised according to IAEA guide SG 50-O3, and format of the Westinghouse Company and US NRC guides for the PWR units were used. After the approval by regulatory body they came into force in the year 1988. The same format is used for TS of NPP V2 and NPP Mochovce since their commissioning. Requirements for TS of waste management facilities are issued by the ÚJD Decree No. 190/2000.

Since 1. 10. 1995 TS of NPP V1 were amended and divided into three individual documents (format and contents follows the IAEA and US NRC guides):

- TS for NPP V1, unit 1
- TS for NPP V1, unit 2
- TS for interim spent fuel storage

In March 1998 were issued new TS for NPP V2 which are divided into two individual documents:

- TS for NPP V2, unit 3
- TS for NPP V2, unit 4

State of fulfilment of TS is continuously followed by shift personnel and daily by technical support personnel.

In case of necessity of TS modification the amendment to the document is issued with the justification and this modification come into force only after its approval by the regulatory body.

Departments of nuclear safety supervision of operator issue periodically quarterly and annually the reports on nuclear safety, which are submitted to the management of power plants and to ÚJD SR. TS for NPP Mochovce were submitted to the ÚJD SR within the review of Pre-operational Safety Analysis Report. ÚJD SR has reviewed and approved the submitted proposal, based on the document IAEA 50-SG - O3. Technically they have the same structure as in the case of NPP Bohunice and they are amended of TS, which come from the special design for the NPP Mochovce.

TS in the SE-VYZ

TS for operation of nuclear facilities for RAW management were recently revised in compliance with the ÚJD SR Decree No. 190/2000 to the following documents:

- TS for operation of NRR Mochovce
- TS for operation of Bohunice Conditioning Centre
- TS for operation of bitumenization facilities PS 44 a PS 100
- TS for decommissioning of NPP A1 including technologies for RAW treatment and storage placed at this NF

H.6.3 Working procedures

Operation, decommissioning, maintenance, systems inspections and solution of transient and emergency conditions of nuclear facilities are performed according to instruction and procedures, which are, required in the ČSKAE Decree No. 6/1980.

System of RAW management is elaborated in detail in the instruction and operating procedures in order to ensure fulfilment of requirements of the Decrees No. 190/2000 and No. 284/1999.

The detail guidance for elaboration of operating procedures is described in the relevant standards and guides of QA system. Each procedure is approved by individual concerned departments and finally is approved by deputy director for operations. The same process is for changes and amendments of the individual procedures. Basic types of procedures:

- Operating procedures
- Inspection and test procedures
- Technological and working procedures of maintenance

Experience obtained during operation results to the modification of procedures as well as to TS modifications.

Radiation safety is at RAW management ensured by:
- design of facility
- dose rate and exposure monitoring (systems of technological and personal dosimetry)
- comply with instructions of dosimetry service (regime and schedule of work, personal protective equipment, shielding, safety distance, defined time, etc.)
- comply with safety and technical-organizational instructions in the QA documentation and subordinated working/operational procedures (PPT, programs, schedules, procedures, etc.)
- regular training of operating staff
- proper use of PPE and protective devices at work performed by operating staff on the NPP units.
- application of feed back from previous events (determination of root causes and corrective measures).

Occupational health and safety and safety of technical devices is described in E.2.3. and F.5.

Fire safety in NF sites is ensured by:
- comply with principles, rules and instructions of Fire Regulations
- regular training of operational staff for fire protection in terms of QA documentation, directives, instructions and regulations SE-EBO, and also of the valid legislation in the area of fire protection.
- regular inspections and proving of fire-brigade and security department
- independent regulatory authority for fire protection (inspections of HS ZbPO).

H.6.4 Engineering and technical support

System of engineering and technical support is. the same on all nuclear facilities of SE, a. s (see G.6.4).
Nuclear facilities of VÚJE are experimental facilities, where above-mentioned support is provided by personnel of Research Institute and co-operated organizations.

H.6.5 Practices for waste characterization and segregation

Within the class b) i.e. low and intermediate level RAW disposable on NRR (see B.3) waste is segregated according to the further processing:

- liquid combustible (for example contaminated oils)
- liquid solidifiable (for example RA - concentrates)
- solid combustible (paper, textile)
- solid - not combustible, pressable (for example: used filters of ventilation system, thin-walled pipes)
- solid not pressable, meltable (bulk of the contaminated metal materials)
- solid not pressable and not meltable (for example: contaminated soil and concrete).

H.6.6 Event reporting system

Operator reports events to regulatory body. System of reporting is the same for all nuclear facilities (see G.6.5).

H.6.7 Conceptual decommissioning plans

Conceptual decommissioning plans as a part of documentation submitted before the operation are required only since the issue of the Act No. 130/1998 Coll. They contain in compliance with the ÚJD SR Decree No. 318/2002 description of technical solution of decommissioning by at least two options including estimation of financial costs, expected radiation situation and amount and activity of RAW from decommissioning. They present requirements on capacity of facilities for management of RAW from decommissioning and requirements on record keeping for data important for planning of decommissioning. Before issue of the Act No. 130/1998 Coll., decommissioning feasibility studies were issued for some NPP, contents of which responded to later requirements of law. Till the year 2000 the conceptual decommissioning plans were issued and reviewed for all nuclear facilities.

H.6.8 Plan for closure of repository

Brief description of the concept of repository closure is a part of pre-operational safety analysis report (see H.5.2). Detail technical solution of final cover is under development.

H.7. Institutional measures after closure of repository

H.7.1 Records keeping

All information about disposed containers including their setting are during the operation conllected in compliance with SE-VYZ QA system

After closure of repository, its actual operator will ensure transmission of information about disposed containers with waste, to the archiving at that institution, which will be determined by state to perform institutional control. Besides of that, the evidence of existence of containers with waste will be created in situ to avoid unacceptable activities, which could be performed by intruder in the site. In accordance with pre-operational safety analysis report, one of the considered solutions is realization of pyramidal object from reinforced concrete out of the disposal site, which has warning as well as informative function (presentation of basic data about the repository).

The parallel solution is of course state archiving of information related to the repository.

H.7.2 Institutional control

Under the term institutional control we understand all activities, performed after the end of disposal of RAW and repository closure. Monitoring systems will be in operation, which will provide information about possible water penetration into disposal space and its further migration. Necessary maintenance of the repository structures will be ensured, and the system of physical protection of repository will be in operation during active period of institutional control.

Duration of institutional controls is influenced by various factors and aspects in mutual interaction, which must be respected at the duration determination. The most important from them are the results of safety analyses, which by determination of the most critical scenarios of possible contact of RAW with public, specify total and concentration activity limits of disposed RAW and provide the basic presumptions for considerations about determination of the duration.

The basic purpose of institutional control is to avoid access of unauthorized persons to the site of repository and control its main parameters during the time, after which it will be possible to release the area for unlimited use.

On the basis of results of safety analysis and in accordance with recommendation of international mission WATRP, the duration of institutional controls 300 years is assumed for NRR Mochovce and for intruder scenarios is considered, that system of final repository cover will prevent the access close to disposed RAW for a period of 500 years.

H.7.3 Intervention measures

It is assumed that intervention measures will be performed in the case of detection of unplanned release of radioactive materials in drainage system of the repository or in some part of the environment in the vicinity of the repository, if any. Extent of corrective measures is not specified.

I. Transboundary Movement

I.1. General requirements for safety at borders

Transboundary shipment of SF and RAW, imports, exports in the Slovak Republic are governed by and must be in accordance with Act No. 130/1998 Coll. and ÚJD SR Decree No. 284/1999 Coll.
All transboundary shipments of spent fuel have been carried out under authorisations and permits of regulatory and administrative authorities of the state of origin following notice of the state of destination and its approval.

I.1.1 Basic requirements for safety documentation

Safety documentation shall contain a set of measures for efficient protection of persons, property and the environment from the consequences of irradiation during the shipment of radioactive materials. This protection is secured by isolation of radioactive contents from the environment, by checking dose rates during shipment, by preventing the criticality from being achieved and by preventing damage to the shipment due to heat being released and absorbed.

These measures must apply to all activities and states associated with the movement of *radioactive materials*; they include the project, maintenance of and repair to *transport equipment* and preparation, loading, carriage including storage during transport, unloading and acceptance of consignment at the point of *shipment* destination.

I.1.2 Issue of a shipment permit

The Authority issues a permit for shipment radioactive materials (Art. 11(1) of the Act) and approval of the type of transport equipment (shipment project approval) (Art. 11(2) of the Act) in the form of a decision.
The decision whereby a permit for shipment radioactive materials is issued by the Authority shall indicate (in addition to common elements):

a) the type of the permit,
b) the identification number assigned by the Authority,
c) the date of issue and validity,
d) the list of relevant Slovak and international regulations, including issue of the International Atomic Energy Agency's Regulations for the Safe Shipment of Radioactive Materials under which the shipment is permitted,
e) restrictions on the mode of carriage, the type of the transport equipment, shipping container, and possible instructions on the transport route,
f) the following statement:
"This permit shall not relieve the consignor from the obligation to comply with the requirements under legal rules of the states to or through which the shipment is to be effected",
g) detailed list of additional operational checks necessary in the preparation, loading, carriage, storage, unloading and handling of the consignment, including possible special provisions concerning storage in terms of safe heat dissipation or subcriticality assurance,
h) reference to information furnished by the applicant relating to special acts to be carried out prior to the shipment,
i) reference to the appropriate approval of the transport equipment or the shipment project,
j) specifications of the actual radioactive content which may not be obvious from the nature of the package system; this shall include the physical and chemical form, the total activity (or activities of various radionuclides), the amount of a possible fissile material in grams, and the notice as to whether the material to be transported is not a low dispersed radioactive material,
k) specification of the appropriate quality assurance programme.

The Authority may also impose other such measures, as it thinks necessary.

The decision whereby the Authority issues a permit for shipment radioactive materials under special conditions shall indicate (in addition to common elements):

a) the type of the permit,
b) the identification number assigned by the Authority,
c) the date of issue and validity,
d) the mode(s) of carriage,
e) restrictions on the mode of carriage, the type of the transport equipment, the shipping container, and possible instructions relating to the transport route,

f) the list of relevant Slovak and international regulations, including issue of the International Atomic Energy Agency´s Regulations for the Safe Shipment of Radioactive Materials under which the shipment is permitted,
g) the following statement:
"This permit shall not relieve the consignor from the obligation to comply with the requirements under legal rules of the states to or through which the shipment is to be effected",
h) reference to the permit for alternative radioactive contents, to the validation of authorisations from other competent authorities or to additional technical data or information at the Authority´s discretion,
i) description of the package system by making a reference to drawings or project specifications. If it proves appropriate, also a reproducible illustration, sized no more than 21 x 30 cm, showing the shipment together with its very brief description, including the structural material, total weight, outer external dimensions, and appearance,
j) brief specification of the authorised radioactive content, including possible restrictions on radioactive content, which may not be obvious from the nature of the package system. This shall include the physical and chemical form, the total activity (or activities of various radionuclides), the amount of a possible fissile material in grams, and the notice as to whether the material to be transported is not a low dispersed radioactive material,
k) additionally for fissile material shipments:
   1. detailed description of the authorised radioactive content,
   2. subcriticality index (SCI),
   3. reference to the documents demonstrating the content subcriticality,
   4. other special circumstances the absence of water at certain free spaces in assessing the subcriticality,
   5. any assumptions under which a reduction in the neutron multiplication is assumed as the result of the actual course of irradiation,
   6. the range of ambient temperatures for which the authorisation for the transport under special conditions has been issued,
l) the detailed list of additional operating checks required in the preparation, loading, carriage, unloading and handling of the consignment, including possible special provisions concerning storage in terms of safe heat dissipation,
m) the grounds for shipment under special conditions (as appropriate/necessary),
n) description of compensation measures to be used if the shipment will be carried out under special conditions,
o) reference to the information furnished by the applicant relating to shipments used or specific acts to be carried out prior to the transport,
p) the statement concerning ambient conditions used in the shipment project unless these are in accordance with paragraphs 4, 5 and 16 of Section VIII in Annex 1 to the Decree,
q) specification of the appropriate quality assurance programme,
r) reference to the carrier identity, as necessary.

The Authority may also impose other measures, as it thinks necessary.

I.1.3 Approval of the type of transport equipment

The decision whereby the Authority approves the type of transport equipment shall set out (in addition to common elements):

a) the type of the approval certificate,
b) the identification designation assigned by the Authority,
c) the date of issue and validity,
d) possible restrictions on the mode of carriage,
e) the list of relevant Slovak and international regulations, including issue of the International Atomic Energy Agency's Regulations for the Safe Shipment of Radioactive Materials under which the type of transport equipment/shipment project has been approved,
f) the following statement:
"This approval shall not relieve the consignor from the obligation to comply with the requirements under legal rules of the states to or through which the shipment is to be effected",
g) reference to the authorisation for alternative radioactive contents, to the validation of approval from other competent authorities or to additional technical data or information at the Authority's discretion,
h) the statement on shipment permit, if the shipment permit and the transport equipment approval are combined in the same decision,
i) package system identification,
j) description of the package system by making a reference to drawings or project specifications. If it proves appropriate, also a reproducible illustration, sized no more than 21 x 30 cm, showing the

shipment together with its very brief description, including the structural material used, total weight, overall outer dimensions, and appearance,

k) specification of the package projects with a reference to drawings,

l) specification of the authorised radioactive content, including possible restrictions on radioactive content which may not be obvious from the nature of the package system. This shall include the physical and chemical form, the total activity (or activities of various radionuclides), the amount of a possible fissile material in grams, and the notice as to whether the material to be transported is not a low dispersed radioactive material,

m) additionally for fissile material shipments:
   1. detailed description of the authorised radioactive content,
   2. subcriticality index (SCI),
   3. reference to the documents demonstrating the content subcriticality,
   4. other special circumstances the absence of water at certain free spaces in assessing the subcriticality,
   5. any assumptions under which a reduction in the neutron multiplication is assumed as the result of the actual course of irradiation,
   6. the range of ambient temperatures for which the approval for the transport equipment under special conditions has been issued,

n) for B(M) packages, the statement specifying those requirements in paragraph 6 of Section VII and in paragraphs 4, 5 and 9 to 16 of Section VIII in Annex 1 to the Decree which the shipment fails to comply with and any explaining information as may be of benefit to other competent authorities,

o) the detailed list of additional operating checks required in the preparation, loading, storage, unloading and handling of the consignment, including possible special provisions concerning storage in terms of safe heat dissipation,

p) reference to the information furnished by the applicant relating to shipments used or specific acts to be carried out prior to the shipment,

q) the statement concerning ambient conditions used in the package project unless these are in accordance with paragraphs 4, 5 and 16 of Section VIII in Annex 1 to the Decree,

r) specification of the appropriate quality assurance programme,

s) reference to the carrier identity, as necessary.

The Authority may also impose other measures, as it thinks necessary.

I.2. Experience with SF transboundary shipment

I.2.1 Shipment of spent fuel elements from A1

Of a total of 572 spent fuel elements from the NPP A1 reactor stored in casks of spent fuel pool, 440 fuel elements had been transported for storage in Russia over the period between 1983 and 1990. 132 so-called non-handling fuel elements were left over at the A1 power plant, which could not be removed from the casks of spent fuel pool by the effect of their volume expansion due to corrosion.
There was carried out modification of equipment for preparation of spent fuel before shipments as to enhance its safety. Given that the 132 fuel elements stored could not be removed from the casks of spent fuel pool, the entire transport technology had to be changed. The fuel elements together with some part of casks were prepared for the shipment.
In view of the need for hermetisation of the fuel elements during the time of the shipment of spent fuel to the Russian Federation, the fuel elements were stored at the interim storage facility - so-called spent fuel dry storage. Upon return of empty spent fuel transport equipment, these were loaded with the fuel elements prepared at the interim storage facility.
The shipment of spent fuel took place using the special train TK -15 comprising two transport equipment. Each of them could accommodate 8 hermetic fuel elements.
The containers were fitted with a device burning hydrogen generated in the hermetic casks. The spent fuel loaded train was transported along a 1435 mm gauge track to the station of Mukachevo, where the transport equipment was repositioned on to a 1520 mm gauge track.
Upon repositioning of the transport equipment, the train was handed over in accordance with technical conditions to the representatives of the MAJÁK Ozersk company (RF) and the shipment to the storage site was provided by staff of this plant.

Nine spent fuel transports took place from 1996 to May 1999, carrying 132 non-handling fuel elements to the Russian Federation. The transportation of all the 572 spent fuel elements from the NPP A1 was thus successfully brought to an end.

I.2.2 Shipment of spent fuel from WWER-440 reactors

Between 1983 -1986, SF transfers from V1 to the Soviet Union (Russian Federation) were carried-out with a total of 697 spent fuel elements. The shipment had taken place according to:

- IAEA´s Regulations for the Safe Shipment t of Radioactive Materials 1985
- the regulations for the safe shipment of spent fuel and atomic power plants of COMECOM Member States
- technical conditions for the acceptance of fuel into the reprocessing plant
- applicable certificates for transport packagings

All the transports were permitted by the ČSKAE´s regulatory body and went reliably and safely.

In January 1987, the Bohunice ISFS was commissioned, where all further spent fuel generated by NPP´s V1 and V2 is stored following its 3-year storage in V1 and V2 SFP´s.

I.2.3 SF shipment from and to the NPP Dukovany

The original WWER-440 design supposed to transport SF after its three-year stay in the unit spent fuel pool to the Soviet Union. Afterwards, the Soviet side demanded that SF be stored for 10 years on the ČSSR´s territory at an ISFS at the respective sites. In February 1984, the Soviet side proposed to store SF for 5 years on the ČSSR´s territory. Under such changed conditions FMoFE abandoned the building of ISFS at both EDU and EMO. During 1985 FMoFE imposed on SEP´s CEO to store SF generated at EBO, EDU and EMO at EBO´s ISFS.

The concept for SF storage from Czechoslovak units at the Jaslovské Bohunice site was finally validated by the Fuels and Energy Deputy Minister and the Czechoslovak Government Commissioner's letter of 17 November 1987.

The shipment of spent fuel from the NPP Dukovany to the NPP Bohunice was begun 30 January 1989. The reshipment came to an end 30 October 1997.

In concluding, it may be noted that all the above SF had been transported and stored under applicable regulations and decisions by regulatory bodies, while complying with general, radiation and nuclear safety and in accordance with the "Limits and Conditions for ISFS". Currently at the ISFS in Bohunice there is none SF from the NPP EDU.

J. Disused Sealed Sources

No sealed sources are manufactured in the Slovak Republic, and according to the data available no manufacture is under preparation, either. All the radioactive sources in use are imported to the Slovak Republic from Germany, the United Kingdom, the Russian Federation, Poland, and the Czech Republic.

In the Slovak Republic, there are 155 companies and organisations holding a licence to use sealed radioactive sources, and 15 companies facing a winding-up still retain sealed radioactive sources. A total of 547 unused Ra-226 radioactive sources with a total weight of about 5,000 mg of Ra are kept at locked-up stores in five hospitals radio therapeutic workplaces.

There are a number of importers and distributors of radioactive sources in the Slovak Republic, of which Huma-Lab Apeko, s. r. o., Košice is the highest-profile. The Ministry of Economy has charged SE-VYZ with the central collection of disused sources for conditioning, long-term storage and disposal. SE-VYZ co-operates in the collection, interim storage and shipment of disused sealed sources with Huma-Lab Apeko, s. r. o., Košice. The disposal of some disused sealed sources at the Mochovce radwaste repository is under preparation.

Roughly 1,300 sealed radioactive sources are currently used in the Slovak Republic. The number does not include Am-241 sealed radioactive sources applied in the fire detectors. A further 1200 sealed radioactive sources are currently not used and are stored by respective users. Orphan and seizured sources are temporarily stored within the “hot chamber” at Huma-Lab Apeko, s. r. o., Košice.

The fundamental legislative requirements for the use of sealed radioactive sources were issued by Act No. 272/1994 Coll. on public health, as amended (Act No. 470/2000 Coll. and Act No. 514/2001 Coll.).

Act No. 272/1994 Coll. as amended, lays down the basic principles for radiation protection, the criteria for classification of radiation sources under 6 categories, the basic conditions and requirements for the use of radioactive sources, dose limits, the conditions for management of institutional radioactive waste, the conditions for discharges and material release into the environment, and defines the basic obligations of radioactive source users. Moreover, the Act sets out the rights and obligations of the Ministry of Health in providing radiation protection, competences of regulatory bodies (Chief Hygienist of the Slovak Republic, regional hygienist and State Health Institutes).

Under Act No. 470/2000 Coll., also the “Central Register of Ionising Radiation Sources in the Slovak Republic” has been set up to be run by the State Faculty Health Institute of the Slovak Republic in Bratislava.

The Slovak Health Ministry’s Decree No. 12/2001 Coll. concerning the requirements for providing radiation protection specifies the requirements for optimising radiation protection in the use of sealed radioactive sources, lays down detailed criteria for the classification of radioactive sources under 6 categories, staff and public exposure limits, the requirements for storage, shipment and use of sealed sources, lays down the requirements and procedures for performing take over tests, leak tests, long-term and operating stability tests of sealed sources, issue of certificates of sealed sources. The Decree further defines the requirements for “controlled areas“, for monitoring workplaces, and emergency and accident procedures.

Act No. 130/1998 Coll. on peaceful use of nuclear energy defines institutional radioactive wastes and delegates ÚJD the responsibility for the supervision over activities related to their conditioning and disposal. The Nuclear Regulatory Authority’s Decree No. 190/2000 Coll. specifies the requirements for these activities.

Act No. 254/1994 Coll. on the state nuclear facility, spent fuel and radioactive waste decommissioning fund defines, inter alia, the procedure for cost compensation for orphan sources management.

The Slovak Health Ministry’s authorisation in relation to sealed radioactive sources shall be required to:

a) put into operation and abolish a workplace involving Class 6 sealed radioactive sources,
b) use Class 6 sealed radioactive sources,
c) take Class 6 sealed radioactive sources,
d) transport Class 6 sealed radioactive sources,
e) manufacture sealed radioactive sources,
f) import, export, distribute, sell and rent sealed radioactive sources,
g) carry out maintenance of and repair to sealed radioactive sources,
h) perform tests of sealed radioactive sources,
i) perform leak tests of sealed radioactive sources,
j) issue certificates for sealed radioactive sources,
k) manageorphan sealed sources,
l) use sealed radioactive sources to sterilise objects,
m) use sealed radioactive sources to irradiate food.

The State Regional Hygienist's authorisation in relation to sealed radioactive sources shall be necessary to:

a) put into operation a workplace involving Class 4 and 5 sealed radioactive sources,
b) abolish a workplace involving Class 4 and 5 sealed radioactive sources,
c) use Class 4 and 5 sealed radioactive sources,
d) take Class 4 and 5 sealed radioactive sources,
e) transport Class 4 and 5 sealed radioactive sources,
f) manage Class 4 and 5 sealed radioactive sources as institutional radioactive waste generated by a workplace involving Class 4 and 5 ionising radiation sources.

Sealed radioactive sources may be shipped:

a) in packages ensuring that the equivalent dose rate in any place of their external surface does not exceed 2 $mSv.h^{-1}$,
b) in a transport equipment that the equivalent dose rate in any place of their external surface does not exceed 2 $mSv.h^{-1}$ and at a distance of 2 m from the surface of the conveyance 0.1 $mSv.h^{-1}$,
c) in road transport by two-track motor vehicles only.

In shipment the surface radioactive contamination of package external surfaces shall not exceed:

a) 4 $Bq.cm^{-2}$, in case of low toxicity beta sources, gamma sources and alpha sources,
b) 0.4 $Bq.cm^{-2,}$ in case of alpha sources other than those in subparagraph a).

The licensee who carried out the shipment of radioactive sources shall make a record thereon. The licensee shall keep records on the shipment of radioactive sources for a period of 10 years of effecting it.

Any sealed radioactive source in use shall have a certificate, which can be issued based on tests and documentation by an authorised organisation. In the Slovak Republic, there is currently merely a single organisation authorised to issue certificates for sealed sources - Huma-Lab Apeko, s. r. o., Košice, which has necessary technical equipment to run tests of sealed sources, ascertain physical parameters of the sources, to identify the source including identifying its production number.

In line with Slovak legislation in force, the Slovak Ministry of Health - Chief Hygienist issues licences to import, distribute and sell radioactive sources, licences to perform take over tests, long-term stability tests, leak tests, issue certificates of sealed radioactive sources, use and transport Class 6 radioactive sources and to manage institutional radioactive wastes of an unknown origin. The supervisory activity for the Slovak Chief Hygienist is carried out by Radiation Health Protection Section staff of the State Faculty Health Institute of the Slovak Republic. In addition, the Slovak Health Ministry manages and is responsible for the performance of the entire supervisory activity in the use of sealed radioactive sources and in the storage, shipment and handover thereof for treatment, conditioning and disposal.

The Regional Hygienists issue licences for the use and shipment of radioactive sources and management of institutional radioactive sources. The supervisory activity for the Regional Hygienist is carried out by radiation health protection departments staff of five State Health Institutes in the Slovak Republic.

The Nuclear Regulatory Authority of the Slovak Republic carries out the supervision over IRAW conditioning, long term storage after conditioning and disposal including disused sealed radioactive sources.

Ionising radiation sources, including sealed radioactive sources, are classified on the basis of health and environmental risks under 6 classes. Sealed radioactive sources are classified as follows:

1. Class 1 includes standard sealed radioactive sources for calibration containing a radionuclide with the activity and specific activity lower than those referred to in Annex 1 to the Health Ministry of the Slovak Republic's Decree No. 12/2001 Coll. (exemption limits)
2. Class 2 includes ionisation fire alarms and standard sealed radioactive sources used for calibration with the activity and specific activity higher than those referred to in Annex 1 to the Health Ministry of the Slovak Republic's Decree No. 12/2001 Coll. and lower than tenfold of the same
3. Class 3 includes sealed radioactive sources with the activity and specific activity higher than tenfold of those referred to in Annex 1 to the Health Ministry of the Slovak Republic's Decree No. 12/2001 Coll. and lower than hundred fold of the same
4. Class 4 includes sealed radioactive sources for industrial indicators and measuring equipment and for non-stationary gamma detectors for defectoscopy
5. Class 5 includes sealed radioactive sources for gamma radiation therapy, including brachytherapy, sources for industrial stationary and non-stationary irradiators,
6. Class 6 includes sealed radioactive sources for large industrial stationary irradiators for irradiation of food and consumables, objects and other materials.

No licence shall be required to use Class 1 radioactive sealed sources and their use shall not be notified, and these sources shall not be registered, either. The use of Class 2 and 3 radioactive sealed sources shall be reported to the competent Regional Hygienist and these sources shall be registered. The use of Class 4 and 5 radioactive sealed sources shall be licensed by the competent Regional Hygienist and these sources shall be registered. The use of Class 6 radioactive sealed sources shall be licensed by the Chief Hygienist of the Slovak Republic and these sources shall be registered. Licences shall be issued for a maximum period of 5 years.

In 1994, the Slovak Government delegated by its resolution responsibility to the Ministry of Economy (MoE) in co-operation with the Slovak Ministry of Health and Environment and the Nuclear Regulatory Authority to prepare a system for management of institutional radioactive waste, including sealed radioactive sources. MoE has delegated the responsibility for the implementation of this activity to SE-VYZ, a. s., which is however not presently fully ready to collect and process a great amount of sealed radioactive sources. The main task of SE-VYZ, a. s. is treatment, conditioning and disposal of radioactive waste from the NPP A1 decommissioning. The possibility to dispose disused sealed sources and institutional radwaste at national repository is under evaluation.
As the Slovak Republic has no central storage facility for disused sealed radioactive sources and no deep geological repository for radioactive waste, the return of disused sealed sourcesis preferred through the importer or the distributor to the producer abroad or their handover to an organisation licensed to collect disused sealed sources (Huma-Lab Apeko, s. r. o.), which will be providing their export, processing and disposal through a foreign organisation.
A significant problem with disposal of disused sealed radioactive sources is represented by high level sources for gamma therapy having an initial activity of 250-550 TBq Co-60 placed at health care facilities and 5000 mg Ra-226, which do not meet acceptance criteria neither for long-term storage nor for repository at Mochovce. In addition, approximately 70 Ra-226 sources with not sufficient integrity release radon, so they pose an increased radiation risk to the personnel and working space contamination risk.
Disused radioactive sources from industrial detection equipment for defectoscopy containing Ir-192 are collected and stored for years with an authorised organisation (Huma-Lab Apeko, s. r. o.) until their activity decay allows the release for a common municipal waste landfill.

Sealed orphan sources, in particular in scrap, are discovered on average twice to three times per year in the Slovak Republic. They may originate from illicit trafficking or a loss of sources in use at certain industrial facilities facing a bankruptcy or winding-up.
Orphan sources are reported to state health institutes and regulatory bodies and following their call an authorised organisation ensures their supervision, transport and safe storage. Financial costs of this activity are covered by the state nuclear decommissioning fund. Such orphan sources are currently temporarily stored within the Košice - based Huma-Lab Apeko´s hot chamber. The most serious was discovery of Co-60 therapeutic sealed source in scrap iron transported to US Steel, a. s., Košice.
There is currently none legislation in the Slovak Republic as would specially govern the management of orphan sealed sources. The general radiation protection principles as laid down by Act No. 470/2000 Coll. and the Decree of Ministry of Health No. 12/2001 Coll. are followed.

K. Planned Activities to Improve Safety

SE-EBO and SE-EMO

In addition to the minimization of the RAW generation, the following activities to improve RAW management safety are planned:

- building up of the shipment route for SRAW shipment from the NPP V2 will make for reducing the personal dose as well as the time necessary for shipment
- additional setting up a contaminated oil storage facility at V2 will improve fire safety in oil product management. The construction project did not envisage the occurrence of oil products and an appropriate oil products storage facility was not established;
- facility of ultrasound level measurement in LRAW store tanks will improve LRAW storage safety and reduce the personnel radiation load resulting from demanding maintenance of the original outdated measuring system;
- putting a waste radionuclide measuring chamber at SE-EMO into commercial operation with a metrological certificate;
- complete the ongoing scientific-technical project to reduce oil and organic solvent contamination;

to construct, commission and operate liquid waste conditioning facility for SE-EMO

SE-VYZ:

At the branch plant SE-VYZ, the following works have been carried out and planned in order to improve safety at the respective nuclear facilities:

ISFS nuclear facility

In 1996, the reconstruction of WWER ISFS started with the goal of Seismic Upgrading and Extension of Storage Capacity. Work currently continues with the implementation of an inspection stand, the manufacture and supply of compact containers KZ - 48 and the implementation of the programme for monitoring long-term service life of ISFS technologies and construction parts. Works are scheduled to be completed in 2007.

Nuclear facility “RAW treatment and conditioning technologies”

Within safety improvement, the monitoring of personnel contamination is undergoing innovation. The work will be finished in 2003.

To improve safety of this nuclear facility, the following measures are still planned to be implemented:

- provide a backup power supply to BBC major appliances in case of a self consumption failure,
- provide a device to dry barrels containing RAW with increased humidity to enable its supercompaction and cementation in FRC.

Mochovce NRR nuclear facility

An additional repository safety assessment has been underway since 2001, setting up a database and to improve safety analyses.

To improve the safety of RAW FRC shipments from the Jaslovské Bohunice site to the NRR Mochovce site, RAW FRC combined shipment is in the works (train and road), which is to replace the current road shipment. The construction in the Jaslovské Bohunice site has finished, difficulties of land purchase from the owners are encountered by the Mochovce site.

A NRR Mochovce electronic security system is planned to be developed with a view to enhancing security and avoid entering of intruders.

RAW integral store

The construction of a RAW integral storage facility is planned in the Jaslovské Bohunice site for RAW non-acceptable for the Mochovce NRR (RAW not complying with the disposal acceptance criteria). The action is scheduled to be completed in 2008.

SE-VYZ radio communications network

With the aim of keep permanent and rapid connection with the operating personnel of nuclear facilities in emergencies with a simultaneous telephone network failure, a SE-VYZ communications network is planned to be launched. Two independent communications systems will guarantee undisrupted communications with the operating personnel, thereby improving the safety of operation of the nuclear facilities.

L. Annexes

Annexes I and II

List of SF and RAW management nuclear facilities

Under Article 2 of the Convention, Slovenské elektrárne, a. s., is the operator of the following nuclear facilities within its subsidiaries:

Atómové elektrárne Bohunice, subsidiary, SE-EBO NPP V1 Units 1 and 2
NPP V2 Units 3 and 4

- Atómové elektrárne Mochovce, subsidiary, SE-EMO EMO Units 1 and 2

Decommissioning of the Nuclear Facilities, Radioactive Waste and Spent Fuel Management, subsidiary of SE, a. s., SE-VYZ:

Interim Spent fuel storage facility (ISFS)

RAW treatment and conditioning technologies

National radwaste repository

VÚJE owns in the Jaslovské Bohunice site a RAW experimental incinerator and an experimental bitumenization line.

Annex III

List of nuclear facilities subject to decommissioning

1) Under Article 2 of the Convention, Slovenské elektrárne, a. s., is the owner of the following nuclear facilities under decommissioning within its branch plants:
Decommissioning of the Nuclear Facilities, Radioactive Waste and Spent Fuel Management, subsidiary of SE, a. s., SE-VYZ:

- NPP A1 including equipment for management of RAW from this NPP

Annex IV

Inventory of stored SF (t HM)

The ISFS design capacity was 600 tonnes of heavy metal, i.e. 5,040 fuel assemblies. SF is stored in special containers. SF leaking fuel assemblies are put as soon as possible in hermetic cases. The ISFS third refurbishment has brought the storage capacity up to 14,112 SF assemblies.

The storage capacity of the V1 spent fuel pools is 1,000 fuel assemblies each at V1 and V2, 2,000 fuel assemblies at EMO. The Slovak Republic's total SF storage capacities are utilised up to 60%.

Annex V

Inventory of disposed of and stored RAW

RAW disposed of at the Mochovce NRR

As of the end of 2002, a total of 336 FRC´s were disposed of, which represents 1,041.6 m^3 of conditioned RAW from the NPP A1, V1 and V2. The main part of the wastes were comprised of concentrates from the above NPP´s in the form of bitumenized products and solid wastes from the NPP´s processed prior to FRC incorporation through high-pressure compaction.

RAW stored at SE, a. s., facilities

RAW stored at WWER-type NPP´s

Because of the original concept for RAW management focused on their conditioning and disposal only after NPP decommissioning RAW had accumulated at storage premises. After building of both RAW treatment and conditioning technologies and the NRR, the amount of RAW stored began progressively falling.

As of the end of 2002, WWER-type tanks in the Slovak Republic held close to 7,631 m^3 of concentrates, which represents 64% of total storage capacity in the Bohunice site.

As of the end of 2002, WWER-type NPP´s stored 3,281 m^3 of solid RAW.

RAW stored at SE-VYZ facilities

Secondary RAW are currently generated at nuclear facilities being decommissioned (NPP A1) in connection with decontamination, dismantling and demolition works.

For historical reasons RAW from the NPP A1 Bohunice pose a special problem, since they had been neither consistently sorted nor recorded. Much of liquid operational RAW has already been treated and conditioned for disposal or the activity level of the wastes was reduced. Continuously formed concentrates (about 10 m^3 per year) are treated every year using bituminization. At the end of 2002, a cumulative inventory of liquid RAW stood at 860 $m^{3.}$

RAW cumulative quantities at A1 reached in 2002 about 1150 m^3 of non-metallic RAW, 1093 t of metallic RAW, and a further 300 m^3 of these RAW in drums. The overall volume of stored contaminated ground and rubbish reached 4063 m^3 in 2002. The volume of stored solid RAW changes, depending on dismantling work, on the one hand, and on their conditioning and disposal, on the other.

Cementation and bitumenization line products, which are also stored at A1 Bohunice storage facilities prior to conditioning, represent nearly 500 m^3.

V.1. Inventory of stored RAW at NPP V1

Utilised capacity of storage premises for SRAW

Storage facility	Overall capacity /m^3/	Utilised capacity /m^3/	Available capacity /m^3/
SK 036/1	115	10	105
SK 036/3	115	115	0
SK 036/4	115	115	0
SK 036/5	200	180	20
SK 036/6	75	40	35
SK 232	200	180	20
SK 241	35	35	0
Total	**855**	**675**	**180**

Storage of air-born filters

Storage facility	Capacity /m^3/	Utilised capacity /m^3/	Free capacity /m^3/
SK 110	150	43	107
SK 036/2	270	270	0
SK 233	70	40	30
SK 238	110	110	0
Total	**600**	**463**	**137**

Utilised capacity of LRAW storage premises

Storage of ra-concentrate

Tank	Capacity [m^3]	Utilised capacity [m^3]	Volume converted in total salinity 190g/kg [m^3]	Summary activity [kBq/l]	Free capacity [m^3]
ZT10N-1	428	80	104	$7{,}66e^3$	348
ZT10N-2	428	177	being filled	being filled	251
ZT10N-3	428	369	706	$1{,}25e^4$	59
ZT10N-4	428	415	679	$3{,}62e^3$	13
ZT10N-5	428	143	150	$1{,}05e^3$	285
ZT10N-6	415	348	325	$1{,}36e^4$	67
ZT10N-7	415	415	756	$6{,}8e^3$	0
ZT10N-8	415	415	576	$1{,}4e^4$	0
ZT10N-9	415	415	579	$7{,}19e^3$	0
ZT10N-10	415	7	13	-	408
Total	**4215**	**2784**	**3784**		**1431**

Storage of low level and medium level sorbents

Tank	Capacity [m^3]	Utilised capacity [m^3]	Free capacity [m^3]
ZT20N-1	428	291,33	136,67
ZT20N-2	428	1,6	426,4
ZT20N-3	150	106,88	43,12
ZT20N-4	150	0	150
ZT20N-5	428	0	428

V.2 Inventory of stored RAW at NPP V2

Utilised capacity of storage premises for SRAW storage

Storage of SRAW in pallets

Storage facility	Overall capacity /pallets/	Utilised capacity /pallets/	Free capacity /pallets/
108/2	640	640	0
108/4	640	592	48
108/5	640	400	240
Total	**1920**	**1632**	**288**

Storage of SRAW at storage facilities without internal structure

Storage facility	Overall capacity /drums/	Utilised capacity /drums/	Free capacity /drums/
108/1	1300	0	1300
108/13	1300	28	1272
108/14	1300	293	1007
108/15	1300	735	565
108/16	1300	39	1261
108/17	1300	1011	289
108/6	770	0	770
108/8	770	0	770
108/10	770	0	770
108/7	460	0	460
108/9	460	0	460
108/11	460	0	460
Total	**11490**	**2106**	**9384**

Storage of air-born filters at storage facility 108/12

Cell number	Capacity /pcs/	Utilised capacity /pcs/	Free capacity /pcs/
25	76	76	0
26	72	72	0
27	72	31	41
28	72	0	72
29	72	0	72
30	72	0	72
31	72	0	72
32	72	0	72
33	72	0	72
34	72	0	72
35	72	0	72
36	72	0	72
Total	**868**	**179**	**689**

Utilised capacity of LRAW storage premises

Storage of ra-concentrate

Tank	Capacity [m^3]	Utilised capacity [m^3]	Volume converted into total salinity 190g/kg [m^3]	Summary activity [kBq/l]	Free capacity [m^3]
0TW10B01	550	550	567	71	37
0TW10B02	550	302	411	208	100
0TW10B03	550	502	811	74	0
0TW10B04	550	550	631	292	0
0TW10B05	550	550	394	242	0
0TW10B06	460	460	361	108	0
0TW10B07	550	552	499	105	0
0TW10B08	550	28		-	522
0TW10B09	550	0	-	-	550
Total	**4860**	**3494**	**3914**		**1209**

Storage of low level and medium level sorbents

Tank	Capacity [m^3]	Utilised capacity [m^3]	Free capacity [^{m33}]
0TW20B01	460	17	443
0TW30B02	460	81	379
0TW30B05	460	0	460

V.3. Inventory of stored RAW at SE-EMO

(a) Liquid RAW

	7KPK10BB002	7KPK10BB03	7KPK10BB04	7KPK10BB05	7KPK10BB06	7KPK20BB01	7KPK30BB01	7KPK30BB02	7KPK30BB03	RAW per year
	active conc.	*active conc.*	*active conc.*	*active conc.*	*active conc. reserve*	*low level ion exchangers*	*sedimentation (slurry)*	*medium level ion exchangers*	*emergency tank*	
tank capacity	*550 m^3*	*550 m^3*	*550 m^3*	*550 m^3*	*460 m^3*	*460 m^3*	*460 m^3*	*460 m^3*	*460 m^3*	
III.Q1998	181									
IV.Q1998	97									
for 1998	***278***									***278***
I.Q1999	53									
II.Q1999	77									
III.Q1999	24									
IV.Q1999	118		65							
for 1999	***272***		***65***							***337***
I.Q2000			131							
II.Q2000			51							
III.Q2000			55							
IV.Q2000			42							
for 2000			***279***							***279***
state as of 31 Dec. 2000	***550***		***344***							***894***
I.Q2001			101			1,7				
II.Q2001			105							
III.Q2001		60								
IV.Q2001		42								
for 2001		***102***	***206***							***308***
state as of 31 Dec. 2001	***550***	***102***	***550***							***1202***
I.Q2002		43						2,7		
II.Q2002		75						6,5		
III.Q2002		57								
IV.Q2002		21								
for 2002		***196***								***196***
state as of 31 Dec. 2001	***550***	***298***	***550***							***1398***
total storage capacity (m^3) / utilised capacity					**2660 m^3 / 1398 m^3**					
utilised storage capacity in percentage					**53%**					
percentage increase in production					**by 8%**					

Solid RAW

	Non-sorted RAW	Combustible RAW	Compactable RAW	Metallic RAW	RAW oils	RAW wet rags	**Total RAW**	Non-active wastes from KP	Non-active metallic wastes	Non-active oils	**Total non-active wastes**	Remark
	kg	*kg*	*kg*	*kg*	*litre*	*kg*	*kg*	*kg*	*kg*	*litre*	*kg*	
III.Q1998	2930											
IV.Q1998	1150			50								
for 1998	***4080***			***50***			***4130***					
I.Q1999		850		25								
II.Q1999		458										
III.Q1999		971		61								
IV.Q1999		1366		244				4730	580	120		
for 1999		***3645***		***330***			***3975***	***4730***	***580***	***120***	***5310***	
I.Q2000		320						3170	430			
II.Q2000		238						1720	880			
III.Q2000		570						1135	460			
IV.Q2000		937	641	700	200			1730	410			
for 2000		***2065***	***641***	***700***	***200***		***3406***	***7755***	***2180***		***9935***	
state as of 31 Dec. 2000	***4080***	***5710***	***641***	***1080***	***200***		***11511***					
I.Q2001		3430	125	2666	75	860		1805	2010			
II.Q2001		1200	200	560				1050	140			
III.Q2001	780	238	31							2m^3 kalov		
IV.Q2001		310	27									
for 2001	***780***	***5178***	***383***	***3226***	***75***	***860***	***10427***	***2855***	***2150***		***5005***	
state as of 31 Dec. 2001	***4860***	***10888***	***1024***	***4306***	***275***	***860***	***21938***					
I.Q2002	-	2950	540	390	-	-		795	130	-		
II.Q2002	-	4374	918	156	-	-		-	-	-		
III.Q2002	-	1274	430	635	-	-		-	-	-		
IV.Q2002	-	120	-	25	-	-		-	-	-		
for 2002	***-***	***8718***	***1888***	***1206***	***-***	***-***	***11812***	***795***	***130***		***925***	
state as of 31 Dec. 2002	***4860***	***19606***	***2912***	***5512***	***275***	***860***	***33750***					
total storage capacity (number of pallets) / utilised capacity - storage facility 108/6							**640 pallets / 640 pallets**					
percentage utilisation of storage capacity - storage facility 108/6							**100%**					

Note: Storage capacity of organised solid RAW storage facility room No. 108/6 is 640 metallic fenced pallets. This capacity is utilised as of 31 June 2002 up to 100%. Wastes produced after the date - hence in III. and IV.Q 2002 - are all putf in 200 l steel drums. As of 31 Dec. 2002, 295 drums are filled with SRAW. These are stored at room No. 305 BPP.

V. 4 Inventory of stored RAW at SE-VYZ

Inorganic liquid RAW

RAW type	Place of storage		Utilised capacity [m^3]	Free capacity [m^3]	Overall activity	
	structure	room No			$\sum \beta,\gamma$ [Bq]	$\sum \alpha$ [Bq]
Washdown water	30	420 (KS2)	0,5	0	5.10^{10}	non-measured
Chrompik		419 (MSN)	12,7	6	$1,135.10^{15}$	$1,937.10^{10}$
		113 (VTP)	0,3	0	310^{11}	3.10^{5}
		717 (VICHR)	0	0	0	0
DS pool water		516	approx. 220	0	$6,89.10^{11}$	$5,8.10^{7}$
D_2O drainage residues		227	27 canist.	0	3.10^{9}	$6,6.10^{4}$
RS decontaminated solutions		516 (PDS No. 367, 168, 269, 338)	approx. 0,4	0	1.10^{11}	approx. 10^{6}
A1 concentrate	44/10	blow case 7/1	5	3,6	non-measured	non-measured
	28	19 (BL VÚJE)	0	4,1	0	0
	41	(evaporator) pos. 32	1	0	non-measured	non-measured
Contaminated aqueous solutions	41	5/11	90	0	$3.6.10^{9}$	non-measured
		5/12	50	40	2.10^{9}	non-measured
		7/1	40	560	$1,35.10^{10}$	non-measured
		7/2	0	600	0	0
	44/10	2/1	0	390	0	0
		¼	0	390	0	0
		blow case 7/1	0	8,6	0	0
		blow case 7/2	0	0	0	0
		tank 10	1,5	0,7	non-measured	non-measured

RAW type	Place of storage		Utilised capacity [m^3]	Free capacity [m^3]	Overall activity	
	structure	room No			$\sum \beta,\gamma$ [Bq]	$\sum \alpha$ [Bq]
Contaminated aqueous solutions	44/20	8 - 4	36,5	0	$2,8.10^6$	non-measured
		1^6	8	0	$\sum\gamma= 8,8.10^5$ $\sum \beta= 7,4.10^6$	$\sum \alpha= 1,8.10^3$
		1^5	9	0	$3,33.10^5$	non-measured
Contaminated aqueous solutions	44/20	1^{11}	0	0	0	0
		12	6,67	0	$\sum\gamma= 8.10^7$ $\sum \beta= 1,2.10^8$	$\sum \alpha= 3,2.10^4$
		9^1	0	0	0	0
Concentrate V1,V2	808	003	5	5	6.10^9	non-measured
		214	9	1	$\sum\gamma= 3,5.10^{10}$	non-measured
Wash water	808	108	1,5	0	$\sum \beta= 2.10^8$	non-measured
		112	2,4	0,1	$\sum \gamma = 5,87.10^6$	non-measured
Special sewage	808	007	9	11	$\sum \gamma = 2,37.10^4$	non-measured

Liquid (organic) RAW

<table>
<tr><th>RAW type</th><th colspan="3">Place of storage</th><th>Utilised capacity [m³]</th><th>Free capacity [m³]</th><th colspan="2">Overall activity</th></tr>
<tr><th></th><th>structure</th><th colspan="2">room No</th><th></th><th></th><th>Σ β,γ [Bq]</th><th>Σ α [Bq]</th></tr>
<tr><td rowspan="4">Dowtherm</td><td>30</td><td colspan="2">516 (PDS)</td><td>approx. 41</td><td>0</td><td>1,77.10^12</td><td>3,14.10^8</td></tr>
<tr><td rowspan="2">28</td><td rowspan="2">19 (BL VÚJE)</td><td>DW-1</td><td>0</td><td>0,200</td><td>non-measured</td><td>non-measured</td></tr>
<tr><td>DW-2</td><td>0</td><td>0,200</td><td>non-measured</td><td>non-measured</td></tr>
<tr><td>808</td><td colspan="2">128</td><td>3</td><td>0</td><td>2.10^9</td><td></td></tr>
<tr><td rowspan="2">Oil</td><td>34</td><td colspan="2">2 (oil management)</td><td>approx. 40</td><td>0,6</td><td>1,29.10^9</td><td>6,88.10^6</td></tr>
<tr><td>808</td><td colspan="2">128</td><td>0,2</td><td>0</td><td>2.10^4</td><td>non-measured</td></tr>
</table>

Radioactive sludge

RAW type	Place of storage		Utilised capacity [m^3]	Free capacity [m^3]	Overall activity	
	structure	room No			$\sum \beta,\gamma$ [Bq]	$\sum \alpha$ [Bq]
DS pool sludge	30	516	approx. 5	-	approx. $1,3.10^{13}$	approx. $2,83.10^{9}$
Chrompik sludge	30	419 (KS1)	approx. 0.5	-	$1,2.10^{12}$	$5,7.10^{8}$
		420 (KS2)	approx. 0,5	-	5.10^{8}	non-measured
		405 DLS (PDS)	approx. 100 kg	-	$4,3.10^{12}$	$4,6,10^{9}$
		419 (MSN)	approx. 450 kg	-	$1,236.10^{14}$	non-measured
Dowtherm sludge	30	516 (PDS)	approx. 0,5	-	$1,6.10^{11}$	$2,4.10^{9}$
Special high level sludge	30	232 (blow case HK)	approx. 0.8	-	non-measured	non-measured
Low level water storage sludge	41	7/1	49	-	$\sum\gamma= 3,6.10^{13}$ $\sum \beta= 3,6.10^{13}$	$\sum \alpha= 1,69.10^{10}$
		7/2	40	-	$\sum\gamma= 6,28.10^{12}$ $\sum \beta= 7,02.10^{12}$	$\sum \alpha= 4,65.10^{10}$
		4/1	3	-	$2,13.10^{11}$	$7,47.10^{5}$
		4/2	2,5	-	$1,78.10^{11}$	$6,23.10^{5}$
		3/1	2	-	$1,42.10^{11}$	$7,47.10^{5}$
		3/2	4,5	-	$3,20.10^{11}$	$1,12.10^{6}$
		2	2	-	$1,42.10^{11}$	$6,23.10^{5}$
		1	4	-	$2,85.10^{11}$	$9,96.10^{5}$
		r.No. 36 (from tank 5/1,J^e-1)	1,3	-	$1,3.10^{11}$	$1,3.10^{6}$
		blow case pos. 41	2,0	-	non-measured	non-measured
Special sewage cleaning sludge N 80,N83/1,2,J1,J2	30	104	approx. 1,2		non-measured	non-measured

Annex VI

List of selected national laws, regulations and guidelines

Act No. 575/2001 Coll. on the government activity organisation and on the central state administration organisation, as amended

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. (as last amended by Act No. 514/2001 Coll.)

Act No. 42/1994 Coll.LL. on civil protection, the most recent amendment No. 252/2001 Coll.LL. (as last amended by Act No. 261/2002 Coll.)

Act No. 95/2000 Coll.LL. on labor inspection (as last amended by Act No. 231/2002 Coll.)

Act No. 330/1996 Coll. on occupational health and safety, as amended

Act No. 264/1999 Coll. on product technical requirements (conformity assessment), as amended by Act No. 436/2001 Coll.

Act No. 90/1998 Coll. on building products, as amended

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

ÚJD SR Decree No. 317/2002 Coll. on the requirements for quality system of licensee and on alteration and amendment to Decree No. 187/1999 Coll.

ÚJD SR Decree No. 318/2002 Coll. on the safety documentation of nuclear facilities and on alteration and amendment to ÚJD SR Decree No. 245/1999 Coll.

Decree of the Ministry of Environment No. 453/2000 Coll. implementing certain provisions of the Building Act

Decree of the Ministry of Environment No. 55/2001 Coll. on land planning documents

Decree of the Ministry of Health No. 12/2001 Coll. on the requirements for radiation safety assurance

Decree No. 718/2002 Coll. on the assurance of occupational health and safety and technical equipment safety

Decree No. 111/1975 Coll. on records and registration of occupational accidents and reporting operational accidents and failures of technical equipment, as amended by Decree No. 483/1990 Coll.

Decree No. 59/1982 Coll. laying down the basic requirements for the assurance of safety of labour and technical equipment, as amended by Decree No. 484/1990 Coll.

Decree No. 374/1990 Coll. on safety of labour and technical equipment in construction work

Government Regulation No. 391/1999 Coll. laying down the details of technical requirements for machinery, as amended

Government Regulation No. 392/1999 Coll. laying down the details of technical requirements and conformity assessment procedures for electric devices that are used within a certain voltage range, as amended

Government Regulation No. 394/1999 Coll. laying down the details of technical requirements for products in terms of electromagnetic compatibility, as amended

Government Regulation No. 400/1999 Coll. on technical requirements for products, as amended

Government Regulation No. 159/2001 Coll. on the minimum safety and health requirements in use of working devices

Government Regulation No. 201/2001 Coll. on the minimum safety and health requirements for a workplace

Government Regulation No. 247/2001 Coll. on the minimum safety and health requirements in work involving display units

Government Regulation No. 117/2001 Coll. laying down the details of technical requirements and conformity assessment procedures for equipment and safety systems intended for use in an explosive environment

Government Regulation No. 444/2001 Coll. on the requirements for use of occupational health and safety labels, symbols and signs

Government Regulation No. 510/2001 Coll. on the minimum safety and health requirements for a construction site

Government Regulation No. 493/2002 Coll. on the minimum requirements for occupational health and safety in an explosive environment (effective as from 1 January 2003)

Government Regulation No. 504/2002 Coll. on the conditions for providing personal protective devices

ÚJD SR 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 documentation of nuclear facilities during decommissioning
BNS III.4.1/2000	Requirements on ÚJD SR permit issue for fuel use in WWER-440 reactors
BNS III.4.3/2000	Requirements on assessment of fuel loading for WWER-440 reactors
BNS I.2.6/2000	ÚJD 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 in-service inspections of nuclear installations classified items

Annex VII
List of International Expert Reports and Safety Analysis Reports

VII. 1. IAEA and other international organisations missions

SE-EBO missions

- An IAEA mission at V2 took place 9-26 September 1996 to assess operation safety (OSART). The purpose of the mission was to assess operating procedures, exchange experience and knowledge, recommendations and proposals to maintain and improve excellent V2 operation standards.
  In the area of NFC, the level of operating documentation, organisational arrangements of activities, state of transportation equipments and technologies, nuclear fuel handling and shipment were evaluated. Assessed were also links and co-ordination of SE-EBO units within the NFC, responsibilities and competences of SE-EBO organizational units, links to SE, a. s. and Slovak regulatory bodies.

SE-EMO missions

- The mission held 9-29 January 1993was the IAEA´s OSART mission aimed to check up the operator's preparedness to start and operate. The final report contains recommendations on management, staff training, operation and maintenance, technical support, radiation protection, emergency planning and preparedness and also on starting covering operational safety and identifying good practices and activities that may be considered by other power plants.
- IAEA mission - Review of NPP Mochovce Safety Measures. The focus of the mission was the verification of safety measures at the NPP Mochovce. The aim was to discuss safety concerns which are known to exist on the WWER-440/213 reactors, the safety improvements already incorporated in the NPP Mochovce project or proposed in the Report on Safety Improvements prepared by EDF and SIEMENS experts in co-operation with Slovak organisations. The review involved the main safety functions - power control, fuel cooling, primary circuit integrity maintenance. In addition, the following areas were subjected to the assessment: control system, power supply, emergency analyses, internal and external risks. The result was a report containing findings and recommendations for each area checked, which were included in the NPP Mochovce safety improvement programme.
- IAEA mission - Review of Seismic Safety for the Nuclear Powers Bohunice and Mochovce. The aim of the mission was to review the method of assessing input data and the earthquake external risk impact on NPP safety. The upcoming PoSAR was used as the basis. The mission assessed the submitted documents and compared them with the recommendations from IAEA Guidelines 50 - SG - S1 relating to NPP siting. In concluding the procedures and results delivered were judged as compliant.
- "NPP Mochovce Environmental Impact Assessment" by the UK-based AEA TECHNOLOGY in 1994, which was part of the "Public Participation Programme Project Documentation" developed by EdF and SE, a. s.
- RISKAUDIT mission (IPSN/GRS consortium operating for France and Germany's national nuclear regulatory authorities) focused on the evaluation of NPP Mochovce safety improvements and project safety assessment was completed 20 December 1994.

All of the technical proposals and organisational measures designed in the final reports of these reviews were either directly or in a modified fashion incorporated in the NPP Mochovce safety improvement programme and implemented through the respective safety measures. The final report prepared by RISKAUDIT in 1999 noted that "the Mochovce power plant is the first Soviet-type nuclear power plant completed in an Eastern European country to reach safety standards comparable to Western standards."

- WANO mission held in November 2002 was aimed to review NPP Mochovce operation, preparation and maintenance. The mission conclusions are used to improve the operating indicators of the NPP Mochovce.

SE-VYZ missions

So far, there has been carried out none international assessment of safety of either ISFS or the other nuclear facilities except for the RAW repository.

<u>A mission to the NRR</u> - In December 1993, ÚJD SR requested the Vienna-based International Atomic Energy Agency (IAEA) to review the Mochovce National Radwaste Repository (NRR) through the Waste Management Assessment and Technical Review Programme (WATRP). Following the request, the IAEA set up a team of five experts from Canada, Finland, France, Germany and Spain to conduct a review, which took place at EMO 14 to 16 May 1994.
The result of the cited review was a material containing recommendations on Mochovce NRR improvements. The aim of the activities to comply with the required recommendations (NRR completion - 1996 - 1999) was, among other things, to improve the quality of the repository through its safety structure improvements such that also A1 and decommissioning RAW and institutional wastes meeting the acceptability criteria could be disposed of there.

VII.2 Assessment of SF management system and equipment operation safety

The assessment of TE and SF management system safety is part of the overall assessment of safety of operation of SE-EBO, SE-EMO and SE-VYZ units and is undertaken by:

- Operator in regular reports and assessments of nuclear safety, radiation safety, occupational health & safety, technical safety of equipment and operation and in SF handling and shipment assessments transmitted to ÚJD SR and also in overall annual NFC Assessments within the quality system at the respective SE a. s. subsidiaries.
- Independent scientific-research and design-engineering organisations holding appropriate licences from ÚJD SR (VÚJE, ao.) in operational safety analysis reports and analyses.
- ÚJD SR and IAEA routine inspections within the agreed or stipulated timetables at SE-EBO, SE-EMO and SE-VYZ units and in inspection protocols.
- External assessment missions (IAEA, WANO, etc.) and their conclusions and evaluations.

More detailed review of safety of V1, V2 units is described in the 1998 and 2001 National Report on Nuclear Safety and also in issued reports on safety.

SE EBO safety analysis reports:

Initial and preliminary safety analysis reports has been prepared for each NPP.

The operating procedure A-01/V2 Safety Analysis Report and the operating procedure A-01/V1 Safety Analysis Report assessing RAW management in four chapters were developed in 1996 and 1998, respectively:

Chapter 1 - Source Term
Chapter 2 - Liquid Waste Management Systems
Chapter 3 - Gaseous Waste Management Systems
Chapter 4 - Solid Waste Management Systems

<u>V1 Original Pre-operational Safety Analysis Report (PoSAR)</u>

It was prepared based on technical projects and documents from the Russian technology supplier in 1978. SF management and safety requirements for this area were part of Chapter: Fuel and Refuelling and Fuel Shipment Systems. The safety requirements in this area were based on the original V1 Russian project concept and were not complete (pursuant to internationally applicable recommendations).

<u>Innovation of the original V1 PoSAR - V1 Safety Analysis Report following gradual reconstruction</u>

It was first published in 1998 and twice revised to 2002. The structure and concept of this Safety Analysis Report is described in the 2001 National Report of the Slovak Republic on Nuclear Safety. The description of SF management is part of Chapter 9.1 of the Safety Report: Fuel Management and Storage. The Chapter sets out in accordance with applicable IAEA and NRC guidelines RG1.70:

- Principle and concept of the project solution to nuclear fuel and HRAW handling systems and equipment.
- Description of NUF management equipment and systems.
- Assessment of systems and equipment operation safety (nuclear safety, radiation safety, technical protection, fire prevention, physical protection).
- Equipment modifications, testing and checks.
- Quality assurance of fuel cycle at V1.

<u>V2 Original Safety Analysis Report</u>

It was developed in 1983 by ČSKAE´s instructions and under the V2 technical project.
<u>Innovated V2 Safety Analysis Report after 10-year operation</u>

It was first published in 1996 and is continuously revised. The structure and concept of this Safety Analysis Report are similar to those with the V1 SAR following gradual reconstruction, including Chapter: Fuel Management and Storage. The SAR includes all the innovations and safety improvement works in the reactor and TE part, including SF management during V2 10-year operation.
The V1 and V2 Safety Analysis Reports after 10-year operation assess RAW management in four chapters:

- Source Terms
- Liquid Waste Management Systems
- Gaseous Waste Management Systems

- Solid Waste Management Systems

SE-EMO safety analysis reports
Initial Safety Analysis Report
Preliminary Safety Analysis Report
Pre-operational Safety Analysis Report

The ultimate goal of the Mochovce NPP operator was to complete and operate the power plant up to such safety levels as comply with the current international requirements and standards and is acceptable to the Western European public. For this reason there had been carried out as early as the construction a number of reviews by international experts and organisations the results of which have been implemented in the project and safety documentation and high safety and reliability levels of WWER-440/V213 unit operation should be attained through their implementation.

An analysis and probabilistic safety assessments for the shut down reactor have been carried out for the NPP Mochovce SFP. Within the analysis, scenarios for SFP cooling system failure were considered:

- in filling up the compact rack with spent fuel,
- in filling up the two racks in emergency fuel take out.

ISFS-EMO
During the preparation of the implementation of the EMO ISFS investment project, the following documents have been developed and brought forward by the appropriate authority:

a) Initial Safety Analysis Report (under Act No. 130/1998 Coll. on peaceful use of nuclear energy).
b) Document developed under Act No. 127/1994 Coll. on environmental impact assessment (EIA).

Both documents were reviewed by the authorities concerned with the following conclusions:
Initial Safety Analysis Report (ISAR): ÚJD SR notified its opinion thereon 29 November 2001, requesting to complete the report to include a RAW management plan. The document in question was developed and submitted to ÚJD SR in May 2002.
EIA document: The document for the proposed activity of EMO ISFS construction was delivered to the Slovak Ministry of Environment in December 2001, elaborating three ISFS storage options - dry option, wet option, and zero option. Following comments on and review of it by respective organisations and the public, the Ministry of Environment established in March 2002 the scope of review under which an Environmental Impact Assessment Report will be prepared.
SE VYZ safety analysis reports:

NPP A1

Decommissioning Plan (developed over 1994 - 1995)
Safety Analysis Report on the 1996 State
Safety Analysis Report on the Current State (2002)
Safety Analysis reports for RAW management technologies within A1 (see D.5.2) for respective equipment so as to be gradually built within the scope of Preliminary and Pre-Operational Safety Analysis Reports

RAW management technologies

as these technologies had been built progressively and only administratively combined at a single nuclear installation, Preliminary and Pre-operational Safety Analysis Reports were developed for the respective parts (see D.3.2)

NRR
Initial Safety Analysis Report
Preliminary Safety Analysis Report
NRR Pre-operational Safety Analysis Report (original)
Pre-operational Safety Analysis Report upon modifications based on the WATRP mission - prior to commissioning

ISFS
An internal safety assessment (within the Slovak Republic) was carried out within the ISFS construction and commissioning and during operation by reviewing safety documentation by Slovak regulatory bodies and organisations (safety analysis reports, quality assurance programme, limits and conditions). Reports on ISFS operation are submitted annually, including ÚJD SR operation assessment. Up to now there have not been carried out ISFS international safety assessment.

Periodic in-service inspections are conducted at the ISFS by ÚJD SR inspectors aimed at assessing the state of selected nuclear facilities, ISFS operation safety and also together with IAEA inspectors at nuclear material storage and record-keeping. Possible shortcomings identified by the inspections are entered in the protocols and the measures are defined as obligatory tasks which the operator continuously performs by determined deadlines.

A Safety Analysis Report after the 9th year of operation was prepared at the ISFS, which served as the basis for taking a decision to expand the storage capacity.

In 2000, an amended Pre-operational Safety Analysis Report was prepared in connection with the ISFS reconstruction, assessing the current state of the facility safety. The format and content of the report was developed based on the US NRC´s recommendation Guide No. 3.44 Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation (Water - Basin Type) ad ÚJD SR´s requirement were based on Art. 72 of CFR Title 10 USA and IAEA Safety Series documents No. 116, 117 and 118.

Annex VIII

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