
SK99K0021

4. General Safety Aspects

4.1 Priority to Safety

4. 1. 1. Nuclear Safety Principles and Definition

Act No. 130/1998 Coll.II. defines nuclear safety as conditions and abilities of nuclear installation and its operating staff to prevent uncontrollable development of fission reaction or to prevent unacceptable leaks of radioactive substances or ionizing radiation into the working or living environment, and to reduce the consequences of accidents and incidents.

Nuclear safety is the responsibility of the operator.
The operator is liable to provide for any aspects of nuclear safety, in particular
- competent staff,
- sufficient funds,
- continuous assessment of nuclear safety during the operation,
- protection against ionizing radiation,
- the issue of operating regulations,
- drafting of working programs.

Moreover, the operator is liable to identify responsibility and liabilities of the individual division so as to achieve efficient management and safe operation of nuclear installations in accordance with safety requirements.

Among other, the application of so-called ALARA principle (As Low As Reasonably Achievable) is made mandatory for any work with ionizing radiation sources.

During practical operation, operators of nuclear installations have to contract other necessary specialized organizations to perform maintenance, operation or research-related activities. Such specialized organizations act as so-called supporting organizations, and participate, by their activities, in assuring reliable and safe operation of nuclear installations since the operator's human resources are unable to perform, either administratively , technically or due to lack of expertise, the works of such organizations.

The operator is responsible to provide the public with nuclear safety-related information. This responsibility does not preclude ÚJD's responsibility to provide the public with its own independent assessment.

Operator shall, draft regulations for any activity performed within the nuclear installation. If operating instructions have not been developed for certain activities, an operating program may be prepared subject to approval by ÚJD-set procedure. This could be a temporary solution which has to be subsequently treated in a regulation.

IAEA recommendations have been incorporated in internal documentation of both the Regulatory Authority and the operator.

The top level at operator's tier are QS concepts for individual areas, including nuclear and radiation safety where the priority of NI safety is expressed over any of the operator's other priorities. The management documents of the QS on nuclear safety, radiation safety and emergency planning apply IAEA safety standards and safety principles laid down in INSAG 3 and INSAG 4. The IAEA safety standards and guidelines represent a basis for the development of the working documents of QS as well as operator's operating documents.

4.1.2 Nuclear and Radiation Safety Policy

Board of Directors of the Joint Stock Company Slovenské elektrárne adopted, on its meeting on November 17, 1997, the Nuclear and Radiation Safety Policy which reads as follows:

1. Slovenské elektrárne, a.s. (public limited company) is a producer of electricity and heat, including from nuclear fuel sources.

2. The Board of Slovenské elektrárne is ultimately responsible for nuclear and radiation safety matters, and it ensures the public that all activities relating to nuclear facilities - from site selection, design, construction, commissioning, operation to decommissioning, including radioactive waste and spent fuel treatment - are permanently under its control, with respect to public health and safety.

3. The Board of Slovenské elektrárne delegates authority to specific members of the Company's executive management and operating plants, which ensure the proper administration and oversight of the nuclear facilities.

4. Main principles of maintaining nuclear and radiation safety are:

   - nuclear safety is the first priority and above to all other interests of the Company
   - upgrading of nuclear safety, based upon the most up-to-date knowledge, with the objective to maintain European standards and International Atomic Energy Agency norms, is a continual and ongoing process
   - safety culture principles and principles of multiple, overlapping levels of safety barriers - defense in depth, are applied to all activities relating to nuclear facilities. The highest priority involves maintaining the permanent integrity of the barriers for controlling emissions to the environment
   - the permissible personal exposure limits and emission into the atmosphere and hydrosphere limits, as established by Slovak legislation and by regulatory authorities, must not be exceeded and actual exposures and environmental emissions must to be maintained as low as reasonable achievable
   - in order to fulfill the responsibilities for nuclear and radiation safety, the Company has:
     * established an independent Nuclear and Radiation Safety Department
     * formed a Nuclear Safety Committee, responsible directly to The Board of Slovenské elektrárne for the evaluation and resolution of complex nuclear safety issues

- developed a Quality Assurance Program, in accordance with requirements of Slovak legislation and relevant regulatory authorities, recommendations of International Atomic Energy Agency and standards of the series STN EN ISO 9000,
- continually utilizes all available knowledge and experience from domestic and foreigner nuclear power facilities,
- maintains an open dialogue with the public, local and regional authorities.

5. In order to fulfill the main principles of nuclear and radiation safety Company spend the necessary resources to ensure the continuing improvement of it's employees' education, qualification and skills.

6. The Company's Nuclear and Radiation Safety Policy is obligatory for all its management and employees at nuclear facilities, who are all required to be aware with this Policy.

7. The Director of Nuclear and Radiation Safety Department is responsible for implementation of this policy, establishment of criteria for the evaluation of the level of nuclear and radiation safety and for their internal inspection.

4.1.3 Role of the Regulatory Authority

ÚJD performs tasks in the area of State administration imposed upon it by the Atomic Act No.130/1998 Coll. II. and by its supporting legislation. This task consists, among others of licensing the use of nuclear energy.

The Authority participates in the improvement of nuclear safety by utilizing the results of scientific and technological development, international cooperation as well as cooperation with other State Regulatory bodies such as industrial safety and health protection, State Mining Administration, and others. The formulation of nuclear safety-related requirements is based on the applicable standards adopted by former Czechoslovakia, so-called ESN standards, standards of the former Soviet Union and, above all, on documents issued by the IAEA (Nuclear Safety Series - NUSS), as well as on other IAEA documents (e.g. TECDOC). The IAEA guidelines developed in the framework of extrabudgetary programs (such as IAEA-EBP-WWER-01 through 11) are used for specific issue assessments.

If needed, the ÚJD takes care of the provision to other State bodies, national and international organizations and the public of adequate information on its mission and responsibilities and on the situation at nuclear installations.

The ÚJD is a State regulatory body in the field of nuclear safety of nuclear installations including selected installations. One major precondition of nuclear safety is the corresponding technical level of these installations.

With respect to the fulfillment of ÚJD's tasks in the field of regulation, the law provides that operators of nuclear installations have to provide free access to the Authority's staff to premises of the

installations, and to workplaces, make them available any requested documents, information, and provide them with the necessary support.

ÚJD, working together with the involved central authorities of State administration, provides them with information on deficiencies identified and on measures ordered to be taken to eliminate such deficiencies.

4.2 Financial and Human Resources

4.2.1 Operation and Safety Improvement Program Financing

The nuclear and radiation safety concept adopted by the Board of Directors of the Joint Stock Company Slovenské elektrárne includes the principal commitment to have available funds necessary to meet the main principles of nuclear and radiation safety and to provide for continuous improvement in the education and qualification levels of the employees. To be able to fulfill this commitment, the Company had to develop its financial strategy which, in addition to the above mentioned tasks, would enable the fulfill ment of and technological base development program (for a short description, see Section 1.2.).

The financial strategy of the Company has been defined as the method of providing for optimum financing of operation-related and capital investment needs of the Company. The strategic objectives of the operator in the field of finances include:

- maintaining of a financially sound company,
- from the long-term aspect, raising funds corresponding to the life time of energy projects,
- acquiring trust of banks and financial institutions.

Acquiring trust of banks and financial institutions is a long-term process requiring consequential analysis of the performance achieved by the Company, analysis of the environment in which the Company is doing business (position on the market, market stability, development and provision for supplies and sales), and development of a transparent projection of future means. The period within which the Joint Stock Company Slovenské elektrárne endeavored to acquire the trust of banks, were the years 1994 - 1995, when several dozens of employees were directly or indirectly participating in the development and presentation of background materials. The results became evident in the subsequent years, when sufficient funds could be raised not only to cover the costs of the extension and implementation of safety measures at the Nuclear Power Plant Mochovce, reconstruction and modernization of Bohunice V-1 units but also to cover environmental projects associated with the fitting of conventional thermal sources of the Company.

The most important results achieved include:

- 12/95 - bond issue at the Slovak Savings Bank (Slovenská sporiteľňa),
- 3/96 - restructuring of loans from Investment and Development Bank, (Investičná a rozvojová banka)
- 5/96 - a loan package for completion of the construction of Mochovce,
- 6/96 - revolving credit by a syndicate of Slovak banks with a 3 years maturity (VÚB),
- 7/96 - syndicated loan from JP Morgan with a 3 years maturity,
- 11/96 - loan from European Investment Bank,

- 12/96 - bond issue at the Slovak Savings Bank,
- 3/97 - loan arranged by Bank of America and The Sumitomo Bank,
- gradual reduction of interest rates and extension of maturity, with guarantees provided by the Company, only with no state guarantees or liens or promissory notes or other forms of guarantees,
- economic rating by rating agencies Standards & Poor's and Moody's Investments at the country rating level.

In this way, SE, a.s. succeeded in securing transactions in a summary financial volume exceeding Sk 50 billion, the restructuring of the loans resulted in an improvement of the balance sheet structure, and in a reduction of the average interest rates from originally 14.3% to 11.6%.

The funds raised from own performance of the Company and from the above mentioned financial transactions enabled to implement demanding safety improvement projects in existing as well as newly constructed nuclear installations, in addition to current repairs of nuclear installations. In recent years, Slovenské elektrárne, a.s. has invested:

- Sk 2 billion (US $ 67 m) - „Small Reconstruction" project, Bohunice V-1units,
- Sk 6 billion Sk (US $ 180 m) - „Gradual Reconstruction„ project, Bohunice V-1 units,
- Sk 8.2 billion (US $ 240 m) - implementation of safety measures at Mochovce units

4.2.2 Financial Sources for RAW Disposal and Processing Programs

On August 25, 1994, National Council of the Slovak Republic passed the act No. 254/1994 Coll.II. which established the State Fund for Decommissioning of Nuclear Power Installations and Management of Spent Nuclear Fuel and Radioactive Waste (ŠFL JEZ), coming into effect as of January 1, 1995. The Fund shall be administered by the Ministry of Economy of the Slovak Republic, and its funds shall be kept at a special account at the National Bank of the Slovak Republic. The Fund shall be generated from the following sources:

- contributions by owners of nuclear power installations,
- fines imposed by ÚJD to natural persons and legal entities according to a separate regulation,
- bank credits,
- interest from the fund deposited in the bank,
- subsidies from State Budget,
- other sources.

The basic source of the Fund shall be contributions by owners of nuclear power installations. In accordance with the provisions of the Act, the operator of nuclear power sources, Slovenské elektrárne , a.s. shall be obliged to contribute to the ŠFL JEZ an amount equal to 10% of all revenues from sales of electricity generated from nuclear sources. An amount of Sk 3.896 billion has been accumulated in the ŠFL JEZ fund between January 1995 and December 1997.

The Fund may be used to provide earmarked subsidies to owners of nuclear power installation or to owners of repository of spent nuclear fuel and radioactive waste based on written application and a project including technical and economic reasoning. The Fund may be used for the purposes of

- decommissioning of nuclear power installation,
- management of spent nuclear fuel,
- management of radioactive waste.

Slovenské elektrárne, a.s., SE-VYZ, currently goes on with stage 1 of decommissioning of the shut down nuclear power plant A-1 at Bohunice. The objective of stage 1 is the transport of the remaining of spent nuclear fuel into the Russian Federation and the re-processing of radioactive wastes. Also studies for selection of the optimum scenario for the final NPP A-1 decommissioning schedule after the year 2007 are under way. The Bohunice V-1 and V-2 units decommissioning study was prepared for SE a.s. by the company DECOM s.r.o. Trnava.

Slovenské elektrárne, a.s. currently stores the spent nuclear fuel at the interim storage site of spent fuel (ISFS) operated by SE-VYZ. The seismic upgrading and interim storage capacity extension project planned for 1997 - 2001 with a total costs of approx. Sk 1.2 billion will enable to store at the ISFS spent fuel from the Bohunice site units throughout the end of their designed life time. The operator is about to review several scenarios for the back end of the fuel cycle. One of them considers storage of spent nuclear fuel at interim storage site, reprocessing of the spent fuel at the manufacturer in Russian Federation and subsequent disposal of the re-processed wastes at the SE, repository. Also, surveys and selection of an appropriate site for a repository of high RAW and spent nuclear fuel in the territory of Slovakia is under way.

4.2.3 Human Resources

Operator's management is fully aware that „good-quality" human resources represent a basic prerequisite for a safe and reliable operation of nuclear installations. „Good-quality" human resources mean a set of physical, professional and psychological competencies of the employees to perform work activities at nuclear installations.

Professional competence of employees is defined as a combination of education achieved, of employee's actual professional knowledge, capacities and skills, habits, experience, and attitudes necessary for the performance of work activities.

The overall competence of the employees to perform work activities at nuclear installations is the responsibility of the operator who is liable vis-a-vis State supervisory authorities.

Any work position has defined criteria of the performance of the function (activities) in the organizational structure of the installation., identifying criteria of the work-related competencies of the employee, i.e. education, health, and/or mental capacity, prescribed types of training. The supervisor of the respective employee is responsible for the fulfillment of these criteria.

A qualification file is kept for every employee, and is supplemented and updated on a continuous basis. The file represents a document of professional competence of the employee for regulatory bodies.

The operator has divisions responsible for conceptual management of human resources. They are called „Selection and Training of Human Resources". The training system is a continuation of the „Uniform System of Training of Nuclear Power Installations Staff" which was established in early 1978.

The staff training is characterized by:

- management regulations,
- training structure.

Training and development of the staff and third persons is performed in accordance with the **management standards** on quality assurance program built and maintained in accordance with:

- legal regulations of Slovakia,
- IAEA regulations, recommendations and guidelines,
- STN ISO 9000 standards,
- management documentation within the SE a.s. Quality System.

The top document of the quality assurance system for the entire area of human resources is the „Human Resources Management Concept for SE a.s.". Subsequent documents to this top document are as follows:

- Management documentation,
- Working documentation,
- Working procedures and methods,
- Training programs.

These documents set the procedures and responsibilities in the area of

- the selection and deployment of employees in the working process,
- the content and extent of staff training, education and development,
- acquisition, maintenance and improvement of qualification - professional competence,
- staff development,
- acquisition and maintenance of general competence of third persons,
- staff re-training.

The system of staff training has the following **structure:**

I Type of training

A. Introductory training
B. On the job training and/or adaptation process
C. Basic training
D. Periodical training
E. Qualification upgrading

II type of training - each type of preparation comprises a set of training types such as:

A. safety at work and health protection
B. fire protection
C. radiation protection
D. basic training - within 6 months of hiring, any employee has to be sent by the corresponding supervisor for basic training
E. on the job training
F. repeated training and re-training of category I employees
G. QA training
H. business management
I. professional courses, training and workshops
E. emergency and accident management training

III training category (basic training only) -from the viewpoint of the work performed and the corresponding professional training, six categories of employees are distinguished:

Category 1 - employees whose activities are of direct relevance to nuclear safety and operation reliability of nuclear installations: operating staff of control rooms, control physicist, simulator training instructor etc. All these employees have university education, and

subsequently attend prescribed training and workshops. They have to successfully pass a demanding exam in front of ÚJD's State Examination Board. A „doubling" of several weeks follows during which the employees have the right to perform interventions at the workplace under the supervision of an experienced colleague. The employee is only authorized to work independently after this period of time. The authorization is valid for two years. The employee is obliged to repeatedly pass the exam in full extent in front of the State Examination Board prior to the expiration of the preceding authorization, to renew the validity of his authorization for additional two years.

Category 2 - technical and administrative staff of operation, maintenance and technical divisions including heads of units, departments, divisions as well as university- and secondary school educated staff holding positions in the divisions mentioned.

Category 3 - service shift and operating staff including employees performing servicing and control operations at the technological equipment.

Category 4 - maintenance crew - employees performing maintenance activities at the technological equipment.

Category 5 - staff working on NPI decommissioning

Category 6- other employees

IV training stages (basic training only)

A. Theoretical training
B. Practical stay on NPP
C. NPP simulator training
D. Training and exam for authorization
E. On the job training
F. Exam for authorization

Training Facilities

Basic training of NPI employees as well as of those from organizations performing special activities at NPI, is performed in training facilities and selected organizations authorized by ÚJD. They are liable, within the extent of their competencies, for the professional competence of employees trained by them.

a) Introductory training is delivered by the power plant.

b) Basic training:

- basic training - repeated training for category I,
- requalification training for category I,
- general training of third persons

is delivered by authorized organization (Training Center of Research Institute of Nuclear Power Plants - TC VÚJE Trnava, and/or the individual NPPs SE-EBO, SE-EMO) in an extent as identified by the ÚJD-issued authorization based on the assessment of the technical condition of the equipment and

verification of professional competence of the trainers; the authorization is valid for 4 years. The training is organized as follows:

- TC VÚJE Trnava delivers theoretical professional training and simulator-assisted training of nuclear power installations staff (with the exception of NPP Mochovce);
- the individual organizations SE-EBO, SE-EMO, SE-VYZ deliver professional training for selected employees and simulator-assisted training (the latter for NPP Mochovce only).

c) Other types of training are delivered at various training facilities or directly within the NPPs SE-EBO, SE-EMO, SE-VYZ, by internal or external trainers.

Simulator-assisted training for the individual NPPs is delivered at the following facilities:

- full-scope WWER-440/213 nuclear power plant simulator at Mochovce; the simulator simulates all standard and non-standard operational conditions of the nuclear power plant. The simulator is a true copy of the EMO unit I control room. It was constructed in accordance with the most recent US standards for staff training and was supplied by companies S3 Technology and Siemens, in cooperation with SE a.s. experts;
- full-scope WWER-440/213 Trnava simulator for V-2 units, It's interconnection with an extended multi-function simulator for V-2 unit set up in cooperation of the companies Corys-TESS, SAIC and VÚJE Trnava, a.s. using RELAP 5 software is under way as a part of the multi-function simulator for V-1units.
- full-scope WWER-440/213 Trnava simulator for V-2 units has so far been used at VÚJE Trnava, a.s. for units V-1 as a non-reference simulator for V230 units, together with a simulation equipment based on SPVS PCs. The Multifunction Simulator for WWER-440/230 units developed in the framework of the PHARE-TACIS project by Corys-TESS, Siemens, Belgatom, Thomson and other subcontractors, was put into operation in February, 1998. The ongoing project is aimed at supplementing the simulator with panels and boards of the unit control room updated for the status after Gradual Reconstruction of V-1 Units, thus making it a full-scope simulator.

A project of the completion of the maintenance staff training center at NPP Bohunice is under development.

Training Programs

Basic training of the employees for the performance of working activities with relevance to nuclear safety follows programs based on the suggestions of organizations authorized to train selected employees and approved by ÚJD.

Basic training programs have been designed for each category of employees separately taking into account the type and stage of training. This training contains the objectives, contents, scope and duration of training along with the methods of training and methods of verification of knowledge acquired.

Authorization to Perform Working Activity (Function)

The organizations authorize the employees in writing for the performance of the working functions; the authorization evidences that the employee in question has successfully passed the prescribed professional training program, and his/her health condition and - if needed - also mental condition makes him/her fully competent for the independent performance at the respective working position.

The validity of the authorization is checked by his/her supervisor on a continuous basis.

Qualification Improvement /Staff Development

Qualification improvement and/or staff development is organized based on individual plans of personal professional training of employees developed by the respective supervisors based on:

- professional training standards for the respective position,
- previous working competence of the employee,
- results of employee's assessment.

Two basic objectives are met in the process of training: the Company's (enterprise's) directed towards the development of human resources, and the individual's directed towards the development of employee's personality and career and his/her ability to adapt to the changing conditions of life.

In improving the qualifications of the employees, an important element is the cooperation with universities, in particular in the form of postgradual and distance learning (in addition to the normal working time) at the Slovak Technical University, University of Economics, and Comenius University, Bratislava.

With respect to the modernization of the technology, changes in organizational structure and implementation of new information systems, special attention is given to a comprehensive, continuous and differentiated training of managers and to the training of selected employees (category 1).

4.3 Human Factor

4.3.1 Management and Organization-Related Measures

Management Documents Related to Human Factor Influence

Operator shall be aware of the fact that the human factor is an important factor determining safe and reliable operation of nuclear installations. Special attention is therefore paid to human factor issues within the quality assurance system. Several QS standards listed below are relevant from this viewpoint:

- Management of Events at Nuclear Installations,
- Survey Control by Enterprise Management,
- Survey Control by Division Managers,
- Survey Controls by Shift Crew,
- Labeling of Technical Equipment Based on S-order, with Fault, Short-term Adjustment and Temporary Change,
- Organization of Periodic Tests of Systems and Equipment,
- Working Ability, Organization and Realization of the Training of Employees and Third Persons,
- Contents and Format of Documents and Instructions for their Preparation,
- Organization of Safe Work and Shift Operation Rules,
- Independent Audit.

Control and Survey Control by Managing Staff

The system of survey control by managing staff is described in detail in the QS document „Survey Control Activities of Managers„. The objective is to introduce a systematic approach to maintain operation quality, and to introduce a system of control surveys to regularly check and document

whether operation-related activities and procedures comply with the regulations, and to timely identify deficiencies. The documents clearly set forth the scope, content and periodicity of survey controls by managers of the various divisions and departments. The managers are regularly trained in issues of controls and their methods..

4.3.2 Methods to Prevent Human Failure

Several methods and systems are in place to prevent human failure. The most important of them include:

- staff training, (see Section 4.2.3. for details),
- documentation of good quality,
- application of a system of rules for performing work on an equipment,
- testing of systems and equipment according to „Surveillance Programs",
- easy overview of labeling within the installation
- survey control activities.

Operating and maintenance staff perform activities according to approved documentation which is kept, updated and supplemented on a regular basis in accordance with the requirements defined by the corresponding quality assurance standards (for details, see Section 5.3.3.).

Manipulations, activities and procedures not described in the applicable operating documentation may only be performed based on a special program developed and approved in advance.

A significant reduction of the probability of errors committed by the staff upon emergency or malfunction events and thus improved in-depth protection can be achieved by introducing symptom-oriented operating procedures. They have been developed in cooperation with the company Westinghouse (USA) for both NPP Bohunice V-2 and the Czech NPP Dukovany. The regulations are subject to validation and operation staff training how to use them, and they are expected to come into force soon. Also, similar procedures are at the same time under preparation for Mochovce and Bohunice V-1.

A system defining rules of work performance at NPP equipment is in place and described in QA standards to prevent errors committed by the staff during repair, maintenance works, reconstruction and design change implementation at technological equipment. The system includes the following types of permits:

- **S-order**, a written order to secure equipment prior to the repair to enable safe performance of repair works; it specifies the type of work, place, time and conditions of their performance. It moreover specifies the responsibility for safe securing of the equipment to be repaired, the necessary safety measures to be taken and conditions of the takeover of the equipment in question for further operation. The order is issued by the installation administrator, and is approved by the Shift Supervisor. S-order does not replace R and B orders if such orders are needed for the performance of the works in accordance with the respective regulations.
- **M-order**, for works at NPP technology to be performed under full operation which bear the risk of reduced output or complete outage of TG, reactor or breaking of OLC. The order is principally issued by the reactor unit supervisor of the respective unit on which works are to be performed, upon consultation with the person responsible to supervise the work. The supervisor of works must perform any manipulation exactly as defined in the M-order, he must not perform any other manipulation or change the order of manipulations. After the completion of the works, the

supervisor of works is liable to close the M order, i.e. to hand over the equipment on which manipulation had been performed, to the unit supervisor, the latter taking it over for further operation.

- **R-order** is issued in addition to S-order to perform works in conditions of increased radiation risk; it specifies place, time and conditions under which the works are to be performed, the necessary measures and means to provide for radiation safety, the composition of the work team and the persons responsible for the keeping of the „Radiation Safety Rules".
- **B-order** is issued in addition to S-order for work on electrical equipment of medium and high voltage. It is issued and closed by Shift Operation Foreman of the electric part.

Any work within the technological premises of a nuclear installation may only be performed provided one of the above orders has been issued. Any work performed by the daily staff must not be started, interrupted or terminated without informing the Shift Foreman and the equipment service crew and without obtaining their approval.

Equipment Testing

A significant reduction of the probability of errors committed by the staff during the testing of equipment is achieved by the application of an extensive „Surveillance Program" system (for details, see Section 5.3.3.).

Surveying Control Activities

The system of surveying control activities has been described in detail in the Quality System documents. It is subdivided into:

- „Survey Controls by the Shift Crew„ - The documents define the obligations of the staff how to perform the controls and how to report any deficiencies identified. Survey Control Sheets have been developed for each shift position, and define the control route and frequency. The objective of this activity is to identify deficiencies on equipment so as to prevent with a high probability, by its periodic performance according to the instructions, faiture to detect important facts due to the failure of the human factor.
- „Survey Control Activities of Managers„ - have been described in the foregoing Section 4.3.1.

Other Measures Taken by Operator to Prevent Human Failure

- documentation for specific units at the site is of a specific color to prevent mistakes due to mixing up units,
- system of labeling of technological equipment under repair and/or with failure; labels or tables are used to provide for visual control and overview of equipment in operation, under maintenance or repair,
- system of control sheets for handing over or taking over shifts by control room staff; the control sheets are used to check and record the status of the equipment, deficiencies, failures etc. to prevent potential errors made by the staff due to non-conveying important information between shifts,
- system of control sheets to take over safety systems which underwent repair; it serves to prevent staff errors during bringing of the respective equipment into the corresponding state,

- independent checking of the correctness of manipulations and of the correct position of elements of safety significant systems and equipment; the objective is to prevent a failure or false operation of systems of safety relevance due to human failure. This is performed by a person different from that who performed or supervised the activity.

4.3.3 Methods to Detect and Remedy Human Failure

Detection of human failure and taking of measures to prevent such failure in the future is an integral part of the system of investigations of events at nuclear installations and their underying causes reasons. Teams of employees have been established for the purpose at the technical support divisions of NPPs to provide for feedback of events at nuclear installations (NIE). Details of the investigation procedures of events occurring at nuclear installations are described in Section 5.5.3. Below are only certain human factor-related aspects are mentioned.

Members of the feedback group assess the efficiency of the process on a regular basis. The results, together with suggested measures and recommendations are included in annual reports submitted to the NPP management for approval.

A total of 20 NIE due to staff failure were recorded in SE EBO in 1997 (25% of the total number), thereof 11 at NPP V-1 and 9 events at V-2.

The NPP staff is regularly informed on the results of the investigation of NIE reasons, and analyses of these investigations are presented during the training. In addition, such information is also available on the Company's computer network.

Also, application of experience from other countries has a significant effect on the prevention of human factor failures. This goes on at several levels:

- Nuclear Power Plants Bohunice and Mochovce are members of the World Association of Nuclear Power Plants Operators (WANO), where this system has been best developed, also thanks to its connection to the Internet.
- Information from foreign NIE are conveyed via ÚJD from the International Incident Reporting System operated jointly with IAEA and the OECD Nuclear Energy Agency (NEA) OECD.
- NuCNet represents an another important world information network to which operator has connection too.
- Power plant managers regularly meet their counterparts operating WWER units in other countries, within the „WWER Club„.
- Exchange of experience between the Bohunice NPP staff and other NPPs abroad: NPP Nogent (France), NPP Grohnde (FRG), on a partnership basis.
- Exchange of experience between NPP Mochovce staff and EdF/France/, NPP Dukovany (Czech Republic) and NPP PAKS (Hungary).
- US Agency for International Development (USAID) supported International Nuclear Safety Program (so-called Lisbon Initiative) oriented towards the development of symptom-oriented emergency procedures, management training and operation control programs.
- Operator and ÚJD employees participation in training courses organized by IAEA, US NRC, Operators Association INPO (USA), the US Department of Energy, EU Member States through PHARE projects etc.

4.3.4 Role of Regulatory Authority

Nuclear energy may only be used or business in the field of nuclear energy may only be done based on a license issued by ÚJD to a natural person or legal entity provided that such person or entity meets the requirements set forth by the Act No. 130/1998 Coll.II.

Pursuant to the above mentioned Act, ÚJD specifies working activities which are directly relevant to nuclear safety. Only employees may perform such activities whose professional competence has been verified by an exam passed in front of the State Exam Board (hereinafter referred to as „Selected Employees). Also, ÚJD specifies, in accordance with the Act, the method, periods and conditions of verification of professional competence of such employees as well as the method of licensing of organizations for the delivery of training for Selected Employees and the approval of the educational programs and the method of training of Selected Employees.

Nuclear safety inspectors are authorized by the Act to verify professional competence of Selected Employees and to withdraw the license if necessary.

The verification method, periods and terms with respect to special professional competence of Selected Employees of nuclear installations, including the conditions for their licensing and the corresponding training have been set forth by CSKAE Decree No. 191/1989.

Requirements with respect to nuclear safety assurance upon the start up and operation of nuclear installations have been set forth by CSKAE Decree No. 6/1980. The Decree refers to employees of nuclear installations and sets forth criteria concerning the qualifications of such employees. The Decree provides that ÚJD shall regulate the overall preparation of the employees and verify the qualification of selected categories of employees whose activities have direct relevance to nuclear safety.

ÚJD Chairman appoints the members of the State Exam Board for the verification of professional competence of selected employees of nuclear installations. The State exam includes a written, oral and, if a change in working activities is concerned, also practical test. Successful passing of the exam qualifies the person to be licensed. ÚJD keeps files of all applications for State exams including copies of protocols on participation in the various parts of the basic training which is a precondition for obtaining the license. Also, ÚJD keeps records of all licenses issued for the performance of activities to Selected Employees, and keeps an updated list of all valid licenses.

For the above category of employees, ÚJD approves training programs for all parts of the basic training as well as training programs for the training concerning change in working activities, as well as post-training programs for employees transferred to a different type of nuclear installation.

In contrast to this category of employees, the second group of employees with relevance to nuclear safety do not participate, within the basic training course, in the training on full-scope simulator, and do not have to pass exams in front of State Exam Board to obtain license. ÚJD also approves training programs for all parts of the basic training of this group of employees as well as post-training programs for employees transferred to a different NPP type. ÚJD at the same time supervises the keeping to thus approved programs.

Regulatory activities based on Act No. 130/1998 Coll.II. concerning nuclear installations staff training are performed through regular inspections. The inspection program is based on the monitoring of the compliance with the requirements of CSKAE Decree No. 6/1980, Section 4. During the inspection, the compliance with training plans as approved by the Authority as well as the implementation of

training program according to the approved training programs are checked. Also, the compliance with NPP guidelines and regulations on criteria for education, professional training and mental capacities of NPP employees is checked. As a part of the inspection, also document files are checked on employees training.

Additional inspections are focusing on the system of retraining of NPP staff. Within the scope of such inspections, ÚJD checks the fulfillment of requirements for retraining of category 2 staff as well as the implementation of the training plan for category 1 staff. Also, the system of record keeping and document filing with respect to repeated staff training is checked within the scope of such inspections.

ÚJD uses inspections to regulate organizations licensed for deliver training to NPP employees. Inspections focus on the review of technical equipment and professional competence of the employees. Organization and records of NPP employee's training are checked within such inspections, along with the basic teacher's (trainer's) documents on NPP staff training, technical equipment of the organization and meeting requirements for the qualification to train Selected Employees of NPP. ÚJD renews, based on positive outcome of the inspection and review, the validity of the license based on which the organization is authorized to train NPP employees.

The technical equipment review also includes licensing and check-up of the simulator. Parameters and input data are verified within the scope of the review, random basis simulation of the technological process is controlled according to the selected scenario. Documentation of any simulator adjustments due to test results and/or due to realization of technical solutions and design changes concerning the unit is controlled. Also, technical and organizational background of simulator training as well as professional competence of simulator trainers is checked in the scope of an inspection. Educational approach, orientation in the training system, training delivery and appropriate evaluation of the participants are all assessed. This assessment of simulator training trainers is a part of the verification of trainers professional competence in front of State Exam Board. If all requirements are met and the exam is successfully passed, ÚJD issues licenses for the training of Selected NPP Employees.

4.4 Operator's Quality Assurance System

4.4.1 History of SE a.s.' Quality System Establishment

The setting up and implementation of the Quality System (QS) of SE a.s. has been based on

- the meeting of the criteria set forth by the regulations of the legal system of the Slovak Republic,
- acting in compliance with international conventions,
- meeting of Company's internal needs for the setting up of an efficient management system.

SE-EBO, SE-EMO and SE-VYZ started with the establishment of their respective quality systems in accordance with CSKAE Decree No. 436/90 Coll. which provided for the requirements concerning the Nuclear Power Plant's Quality Assurance Program. The process started by issuing the above mentioned Decree in 1990. Operational Quality Assurance Programs were conceived in broader terms, exceeding the framework of the requirements of the above mentioned Decree. Therefore these programs are considered to be the quality system in branch plants which operate nuclear power

installations. Experience from Western European nuclear power plants and/or companies operating NPPs such as MAGNOX ELECTRIC - United Kingdom, and IVO, Finland, were used in this process.

SE-EBO, SE-EMO, SE-VYZ currently have quality systems (Quality Assurance Programs) in place, and they meet the requirements set forth by the Slovak legislation. The systems however need continuous improvement along the lines of the growing requirements for quality assurance at nuclear power plants.

4.4.2 Quality Concept

The management's of SE-EBO, SE-EMO, SE-VYZ issued quality concepts which specify the main objectives and basic directions in providing for safe, reliable, efficient operation of nuclear power installations with minimum impact on the environment.

The Joint Stock Company Slovenské elektrárne was established in 1994. It comprises plants also branche SE-EBO, SE-EMO, SE-VYZ. Gradually, the liability for nuclear and radiation safety has been transferred to the management of the Joint Stock Company. Board of Directors of the Joint Stock Company decided, in 1996, to set up a uniform quality system for the entire Joint Stock Company. SE a.s.'s quality concept was proclaimed, and Development and Implementation Project Plan was drafted. SE a.s.' Board of Directors has created all conditions for a unified Quality System within the entire 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 elektráme.
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 being set up as a single management system which includes all activities and processes running within SE a.s. and which meets the requirements of

- regulations of the legal system of the Slovak Republic,
- ISO 9000 and ISO 14 000 series standards,
- IAEA.

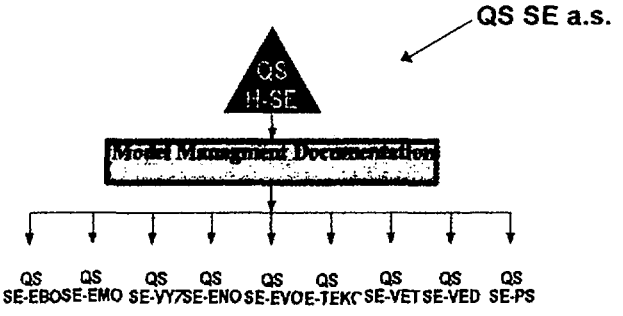
SE a.s.' Quality System is structured

- to follow the organization structure of the Joint Stock Company Slovenské elektráme
- according to activities - processes performed at the Joint Stock Company Slovenské elektráme

4.4.2.1 SE a.s.'s Quality System Structure According to Company's Organization Structure

SE a.s.'s Quality System (QS) consistis of :

- Headquarters Quality System (H-SE)
- Quality Systems of Branch Plants,
- Model Management Documentation.



The Figure below illustrates the SE a.s.' Quality System structure according to the Company's organization structure.

The model management documentation for branch plants has the role of prescribing a model procedure of responsibilities and competencies for individual activities (processes) delegated to the branch plant with respect to the activity in question. Based on the model documentation, each branch plant (SE-EBO, SE-EMO, SE-VYZ...) develops the documentation of its own Quality System. SE a.s.' Quality System applies to all organizational divisions of the Company.

4.4.2.2 SE a.s.' Quality System Structure by Activities

SE a.s.' Quality System is based on activities (processes) which are important for the fulfillment of Company's mission. Such activities have been selected so as to cover all processes performed at the individual production plants and organizational units of the Company and to account for the respective particularity. In other words, not only output product quality criteria but also any requirements put on electricity and heat production and distribution processes are accounted for, i.e. safety, reliability, efficiency, environmental protection. Owing to this, SE a.s. QS may be considered as a management system.

The activities have been classified into three groups as follows:

- *Basic QS activities* - activities derived from meeting the requirements of standards put on quality system; they are mostly implemented at each organizational unit.
- *Specific activities* - of importance from the nuclear and radiation safety viewpoint; they include activities specific for the nuclear power sector, and their objective is to secure the meeting of the nuclear and radiation safety criteria and their control.
- *Additional specific activities* - activities with respect to which no direct criteria of quality system standards have been specified but which affect the operation and the management of the Company to a significant extent or which may be specific for certain organizational units such as hydroelectric power plants, conventional power plants, transmission grid and/or the Directorate.

4.4.3 SE a.s.' Quality System Development and Implementation Project.

The building and the implementation of SE a.s.' Quality System follows the SE a.s.' Quality System Development and Implementation Project Plan (hereinafter referred to as Plan). In addition to describing the Quality System structure, the Plan also identifies:

- the organization of the SE,a.s. QS Development and Implementation Project,
- training of SE, a.s.' employees to provide for the implementation of SE,a.s. QS Development and Implementation Project,
- the time schedule and sequence of the implementation of SE, a.s.' QS Development and Implementation Project.
- sources and support needed to implement the SE,a.s.' QS Development and Implementation Project.

The Plan has been spread over a period through the year 2000. The implementation of the SE a.s.' QS Development and Implementation Project has, with respect to the existing Quality Systems of SE-EBO, SE-EMO, SE-VYZ the role of unification and/or convergence of the existing systems while utilizing their best characteristics.

4.4.4 Verification of SE a.s.' Quality System

The efficiency of SE a.s. or SE-EBO, SE-EMO, SE-VYZ quality system is being verified through

- internal reviews envisaged by the system itself,
- reviews, inspections and controls performed by ÚJD.

Any findings of the reviews, inspections and controls are analyzed at the corresponding management level, and remedial and preventive measures are taken the implementation of which is checked. This is how SE a.s.' Quality System is continuously improved.

4.4.5 Role of Regulatory Authority

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 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 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'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 focuses on two basic activities:

1. Approval of quality assurance systems

This is done at two levels:

a. 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.).

b. 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 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 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 is also responsible for the enforcement if requirements set forth in

applicable generally binding legal regulations or ÚJD'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.

4.5 Safety Assessment and Verification

4.5.1 Characterization of Operated Reactors

The mix of the individual types of operated reactors includes WWER 440/V-230 units (2 units at NPP Bohunice), WWER 440/V-213 units (2 units at NPP Bohunice and 1 unit at NPP Mochovce), and WWER 440/V-213 units under construction (3 units at NPP Mochovce). The V 230 reactors are significantly different from model V 213 as for their design and safety elements. The reactors V-213 at NPP Bohunice and at NPP Mochovce are based on identical design principes. Type V-213 NPP Mochovce reactors however had a number of improvements in their original design and also contain new safety elements. The safety of the original project was reassessed during the construction of NPP Mochovce, and the project became subject of numerous safety upgrading measures.

4.5.2 Safety Assessment of Nuclear Reactors by ÚJD

The original design for V-230 and V 213 reactors was based on Soviet standards for nuclear power plants design (OBP). Those reactors however did not meet nuclear safety standards as defined by the IAEA NUSS series. This was the main reason to start, after 1989, a gradual reassessment of nuclear safety of the operated units and units under construction. The assessment safety was conducted by Slovak engineering organizations as well as by international review missions. The IAEA played a significant role in the safety review process: it organized several missions within 1991 - 1997 focusing on the review of design and operation safety of nuclear reactors in Slovakia. As a result of the reviews, a number of documents were drafted summarizing shortcomings and faults identified from the viewpoint of nuclear safety. These results have been included in the IAEA documents TECDOC 640 WWER 440/230 Ranking of Safety Issues and IAEA-EBP-WWER-03 Safety Issues for WWER 440/213 and their Ranking. The documents mentioned became the basis for defining safety upgrading programs for V-230 and V-213 reactors.

4.5.3 Basic Principles of ÚJD-Issued Decisions on Safety Upgrading of Operated Reactors

Similarly as in many other countries, neither Slovakia has officially codified rules or requirements with respect to safety upgrading of nuclear reactors. Consequently, ÚJD's requirements are specified for individual reactor types. Safety upgrading programs are developed by nuclear power plant operator, who bears overall responsibility for nuclear safety.

In Slovakia, the nuclear power plants safety concept has been based on so-called „defence in-depth", a strategy used generally world-wide in designing and operating nuclear power plants. In assessing NPI safety, ÚJD assesses the ability of the installation to fulfill safety-related functions along the lines of the design, to ensure the required in-depth defence level.

The safety upgrading process in Slovakia follows the current international safety standards. Certain specific measures were set based on a comparison of selected national standards with those applied

in developed countries. As a rule, safety upgrading measures for WWER 440 reactors have generally been oriented towards improving reliability, redundancy (in particular with respect to V-230 reactors), and physical separation of safety systems.

Lists of safety-related imperfections the treatment of which is included in the safety upgrading program for specific reactor types have been a result of recent developments in the field of primary circuit integrity, assessment of events at nuclear installations, results of beyond-design basis accident analyses etc.

ÚJD uses deterministic approach to effectively manage the safety upgrading process, in particular to improve the safety of emergency systems (independence, redundancy). PSA for specific reactor is used to prioritize the individual safety improvement measures, in particular those which may contribute most to the core melt-down.

Safety upgrade related requirements are partially linked to the probability of accidents. Acceptance criteria set forth by ÚJD for emergency analyses are generally expressed in terms of acceptable radiological consequences which differ according to the probability of the initiation event. In addition, conservative or so-called best estimate procedures were described for emergency analyses. Best estimate procedures are only accepted for accidents with the least probability of a specific initiation event (below 10^{-6}).

An additional principle applied by ÚJD in the safety upgrading process is the limitation of the operation duration of nuclear power plant units by issuing only approvals for operation for specified period of time; this enables the management of the safety measure implementation process. This procedure has so far only be applied with respect to NPP Bohunice V-230 reactor units.

4.5.4 ÚJD Requirements with Respect to NPP Bohunice WWER 440/V-230 Units Safety Upgrade

The safety upgrading program for V-230 type reactors was first started in 1985 based on recommendations from the former Soviet Union. Main attention was paid to embrittlement of reactor pressure vessel and to seismic upgrading.

Based on a review of the nuclear safety of reactors V-230, Czechoslovak Atomic Energy Commission (CSKAE), the predecessor of ÚJD, by CSKAE Resolution No. 5/1991, defined measures to upgrade the safety (known as „Small Reconstruction„), in response to the safety shortcomings identified. The „Small Reconstruction" was completed in 1993. It focused on the most urgent safety aspects, in particular on the tightness of the confinement, seismic upgrading, reactor vessel integrity, emergency sources of electric feeding, reliability of steam generators feed water systems, the application of „leak before beak" principle, on the reduction of fire risk and the capacity of the fire extinguishing equipment, etc. The implementation of the mentioned safety-related measures was a condition for the licensing of further operation through the year 1995.

Being established in 1993, ÚJD took additional measures to upgrade V-230 reactor safety. Based on the inception safety report for so-called „Gradual Reconstruction of NPP V-1", ÚJD issued Resolutions Nos. 1/94 and 110/94 in 1994, which regulated the conditions for further operation of NPP V-1 after 1995 until the end of the designed life cycle. ÚJD Resolution No. 1/94 contained additional 59 safety measures to be gradually implemented within 1996-1999.

ÚJD Resolution 1/1994 had five topics-based parts. In each of them, ÚJD prescribed measures to upgrade safety level; any further operation of the power plant would be conditional on the implementation of those measures.

Part one took measures to maintain primary circuit integrity including analyses of the integrity of reactor pressure vessel. Part two contained measures focusing on a safety improvement of the reactor core cooling systems during the operation and accidents. Part three, Reactor Core Cooling during LOCA, set forth conditions for an improved core cooling to manage a new level of design basic accident, i.e. when a primary circuit pipe of the diameter of 200 mm bursts (the original design basic accident only considered the bursting of a primary circuit pipe of a diameter equivalent to 32 mm). Part four contained measures to improve the safety level of confinement , in particular by improving its tightness and demonstrating integrity upon LOCA. Part five focused on an improvement of the safety level of auxiliary systems of the nuclear power plant such as process water, electric feeding, and control and monitoring system.

Resolution No. 1/1994 was also based on recommendations for safety level upgrading contained in IAEA documents developed as a part of the TECDOC 640 document: Ranking of Safety Issues for WWER 440/230 Reactors. Because of the extent of the project, the deadlines for the measures to be implemented have been spread over the period of four years. ÚJD Resolution No.110/1994 complemented CSKAE Resolution No. 5/1991 and ÚJD Resolution No. 1/1994, by defining conditions to be met by operator to obtain license for further operation of the respective unit. The license validity has been restricted to one year.

In assessing the safety level of nuclear power plants, results of probabilistic safety analyses (PSA) have been used since 1995; they are also used to assess the benefits of suggested safety improvements.

4.5.5 ÚJD Requirements with Respect to NPP Bohunice WWER 440/V-213 Reactors Safety Upgrading

New safety-related requirements for V-213 have arisen from the outcomes of periodic safety reviews, operation-related experience, PSA analyses and recommendations of international missions.

ÚJD responded to the situation following the Safety Report After 10 Years of Operation by issuing the Resolution No. 4/1996 which contained measures to upgrade safety in three parts. Part one contained measures concerning the completion of the safety report after 10 years of operation. The safety report, as a basic document providing evidence for the safety level of the nuclear power plant, was updated according to the actual state-of-the-art condition of the plant, in particular with respect to better safety analyses. Measures to complete the safety report were taken by ÚJD based on the IAEA 1994 Mission[1], PSA analyses conducted by Nuclear Power Plants Research Institute, Trnava, and analyses developed by ÚJD staff. Requirements to complete the safety report in addition to general issues, also concerned the integrity of components at the primary circuit pressure limit, seismic review, safety analyses, additional safety analyses, limits and conditions.

Part two identified technical measures for safety upgrading of emergency systems and auxiliary systems of safety relevance. This part further specifies requirements with respect to the development of a modernization concept for the control and instrumentation systems. The resolution also contains

[1]Bohunice V-2 Safety Review IAEA 1994

organization-related measures to improve operation documentation, regulations for tests of equipment and emergency planning. This procedure prescribed by ÚJD shall maintain the required safety level of the nuclear power plant.

Part three prescribed the operator to periodically review the nuclear power plant safety following the schedule developed by ÚJD. From the aspects of their deadlines, two types of measures were distinguished: short-term measures including organization-related measures, and completion of the safety report. Long-term measures represent requirements concerning the specification of objectives, development of concept and safety upgrade program which is currently under development.

Annex to Resolution No. 4/1996 contained ÚJD comments on the individual chapters of the Pre-Operation Safety Analysis Report.

4.5.6 ÚJD Requirements with Respect to NPP Mochovce WWER 440/V-213 Reactors Safety Upgrade

The construction of the nuclear power plant Mochovce started in 1984 when the former Czechoslovak Atomic Energy Commission (CSKAE) approved, by Resolution No 23/1984, the issuance of the building permit for NPP Mochovce, based on a review of the safety documentation pursuant to Act No. 28/1984 Coll.

The construction of NPP Mochovce was suspended in 1990 due to unclarified issues concerning the instrumentation and control system and also due to lack of funds needed for the completion of the construction. The construction of the two first units was resumed in 1996 offer both above mentioned difficulties have been resolved.

After 1989, NPP Mochovce used own means and assistance of international expert missions to make a number of steps to reassess the safety of the original NPP design.

Several international missions[2] were invited to NPP Mochovce since 1994 to review the nuclear power plant safety level. The document „Technical Specification of Safety Measures" (TSSM) was developed based on the recommendations of the international expert missions (IAEA, Riskaudit, EDF) in 1995. The document has become a basic reference for the development of the safety upgrade program for NPP Mochovce. Terms of Reference for design amendments have been developed based on TSSM, and they are expected to be implemented even before the commissioning of the NPP. The amendments mainly concern design adjustments in response to the most serious faults identified upon the safety review of the original project.

The numbers of measures included in TSSM (87) corresponds to the numbers of measures stated by the IAEA document „Safety Issues and their Ranking for WWER 440, Model 213 NPPs„, IAEA-EBP-WWER-03. All the measures suggested by Riskaudit[3] have been included in the 87 measures which represent a more comprehensive understanding of the safety level. The difference in the numbers of measures shown in Riskaudit report and TSSM is due to a different structure of both materials. The TSSM document, similarly as that of IAEA, distinguishes between three categories of safety upgrading measures based on their safety relevance.

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[2]IAEA Safety Review Mission, 1994, Riskaudit Mission 1994, EdF Safety Improvement Mission, 1993
[3]Riskaudit Report N^0 11, July 1994

The role of ÚJD is to assess the level and the status of the NPP safety and the degree to what the NPP meets the requirements and recommendations of the national and/or accepted international regulations and instructions. Based on such a review, ÚJD approves the license to be issued by the Building Authority (District Environmental Office).

ÚJD has consistently monitored and reviewed the implementation of safety upgrading measures since the time of their formulation. Operator is responsible to submit monthly reports on the implementation of those measures. With respect to category three measures (there was no category four) measure which are not fully realized prior to the start of operation, ÚJD shall require satisfactory substitutional measures to be taken prior to the start of operation. Such substitutional measures shall be assessed and controlled by ÚJD. All the original measures aimed at safety upgrading shall remain a precondition for approval of commercial operation. In other words, any category 1 measures, even if of less safety relevance, will have to be implemented by or during the first fuel reloading on unit one.

The most comprehensive review of the implementation level of safety-related measures was conducted by ÚJD prior to the approval of the first fuel loading. Another comprehensive review was performed prior to approving the commercial operation.

4.5.7 ÚJD Requirements with Respect to Periodic Safety Reviews

The results of the periodic safety review of the operated V-230 and V-213 reactors prescribed by CSKAE and subsequently by ÚJD are: (1) requirements were put forward to complete the safety reports to match the format usual in developed countries, (2) requirements were set up for safety upgrade of nuclear reactors, (3) requirements were set up for safety upgrade of reactors under construction, and (4) requirements were set up for systematic periodical safety reviews of all nuclear reactors in Slovakia. The requirements concerning periodical safety reviews were prescribed by ÚJD in the safety instructions on Periodical Safety Reviews developed on the IAEA safety instruction 50-SG-O12 as well as based on experience from the contents and application of periodical safety reviews in developed countries.

4.6 Radiation Protection

4.6.1 Radiation Protection-Related Legislation and its Implementation

Radiation protection in Slovakia is regulated by Act No. 272/1994 Coll.II. On the Protection of Human Health as amended from time to time. The Act provides for the principles of health protection against harmful effects of ionizing radiation, it sets exposure limits, methods of handling of ionizing radiation sources, and defines the method and the criteria of licensing of activities connected with the handling of ionizing radiation sources as well as removal of radioactive waste .

The Act accounts for ICRP (International Commission on Radiological Protection) criteria as well as those of IAEA Safety Series No. 115: International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources. Implementation of Radiation Protection-Related Legislation

The applicable legislation in Slovenské elektráme's quality assurance system for the area of radiation safety has been reflected in the „Basic Guideline". At branch plants, the national legislation as well as international commissions recommendations (ICRP a IAEA) have been incorporated into guidelines and working procedures as well as into the limits of exposure of persons and limits for atmospheric and hydrospheric emissions of radioactive substances from NPPs.

Dose and occupational limits have been set on quarterly and on annual basis, the own intervention limits have been set lower than those set by the legislation: if exceeded, the reasons are investigated and they have to be properly justified.

Radiation safety principles are accounted for during any work, in particular the ALARA principle, protection optimization principle, and dose and risk limiting principle.

Limits on environmental emissions of radioactive substances are set by the Regulatory Authority. The purpose is to avoid, upon normal and abnormal operating conditions, the exceeding of effective doses received by the population, as set by the national legislation and international recommendations.

4.6.2 Radiation Monitoring by Operator

4.6.2.1 Radiation Monitoring at SE, a.s.' Nuclear Installations

The radiation monitoring system at nuclear installations and their surrounding areas is a very consequent, good-quality and reliable process. It has two parts:

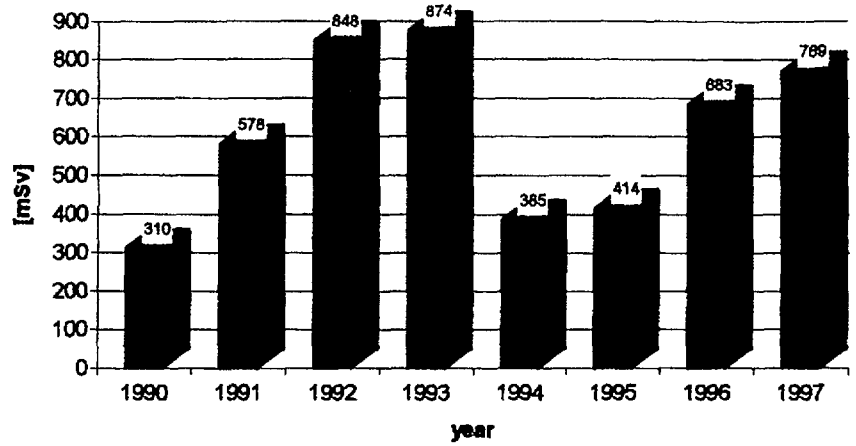
- radiation monitoring at the power plant premise,
- assessment of the impact of the nuclear power plant operation on the NPP surroundings areas.

Radiation monitoring at nuclear installations represents a set of organizational and technical measures. The aim is to provide information the radiation status within the nuclear power plant, the quality of the technological process of the power plant (tightness of equipment, radiation accumulation at the plant, etc.), assessment, directing and planning of personal doses for NPP employees, including the evaluation of internal contamination of persons and contamination of equipment surfaces. Data from the monitoring network are also made available to certain neighboring countries.

Protection of nuclear installations employees against the harmful ionizing radiation is based on continuous surveillance of the working conditions along with monitoring of dose load and medical monitoring of the health condition.

Radiation status in the working place is monitored using stable dosimeters and monitors of gamma radiation, volume activity of airborne particles and gases, and the same parameters are additionally measured using portable devices. Personal doses are evaluated, directed and planned according to the basic principles of protection against harmful radiation so as any activity which results in persons being exposed to radiation has to be justified, optimized and limited. Personal doses are monitored using film dosimeters, thermoluminescence dosimeters and signaling dosimeters which enable flexible evaluation of personal doses. Also, examination of internal contamination is a part of employees monitoring. Fig. 4.6.1 illustrates the development of average collective dose equivalent per one SE-EBO unit.

Fig. 4.6.1: Average collective dose equivalent per one SE-EBO unit



4.6.2.2 Atmospheric and Hydrospheric Emission Control Systems

Fig. 4.6.2 Rare gas emissions from V-1

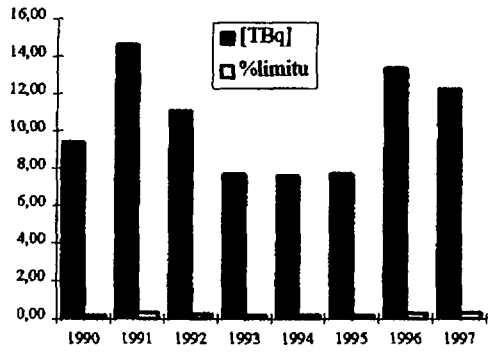
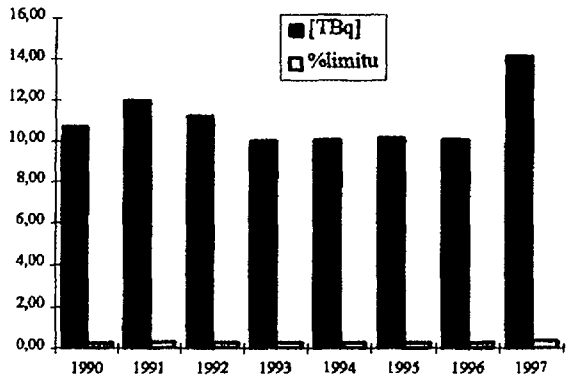


Fig. 4.6.3 Rare gas emissions from V-2



Atmospheric emissions are continuously monitored by measuring equipment attached to ventilation stacks. The devices continuously monitor the activity of gases, airborne particles and iodine. Moreover, there is a system for continuous airborne particles sampling for gamma-spectrometric analyses and alpha-nuclide and Sr 90 contents.

Hydrospheric emissions are continuously controlled for identification of deviations from normal conditions. Continuous sampling of effluent waters serve balancing purposes of total activity beta radionuclides activity, tritium, gamma spectrum and Sr 90 and Pu monitoring.

4.6.2.3 Monitoring of Environmental Impacts

Radiation monitoring systems at nuclear installations also include assessment of NPP operation impact on the surroundings. Assessment of environmental impact of NPP operation starts by pre-operation radiation monitoring at the construction site and within its surroundings. The obtained set of data serves for actual comparison of environmental impacts of nuclear power plants operation.

Environmental impacts of nuclear power installations are monitored and documented by External Dosimetry Laboratories. The scope of the controls is determined by a monitoring program which sets mandatory minimum numbers and types of environmental components to be monitored. From the aspect of the potential environmental impact of nuclear power installations, the components of the environment monitored include air, water, soil and related agricultural products as a part of the food chain. More than 1,150 samples are taken from the environment annually.

A teledosimetric system has been set up to improve the control quality of the impact of nuclear installations and their surrounding. The teledosimetric system is computer-controlled, and enables sampling of airborne particles, radioiodine, dosimetric quantities within the given site as well as meteorological data. Selected results of teledosimetric monitoring are on-line transmitted to the KKC ÚJD.

Results of direct measurements by stable monitoring stations as well as the results of environmental sample analyses indicate that the operation of NPP Bohunice units has no impact on the surroundings.

In the view of the very small amounts of atmospheric and hydrospheric emissions from NPP Bohunice, exposure doses of the general population are analyzed to assess the impact of NPP Bohunice operation. This analysis is based on actual discharges and efficiency of radioactive substances for the individual years, accounting for the actual meteorological situation as recorded by the SHMÚ meteorological station at Jaslovské Bohunice.

This analysis is conducted using standardized software RDEBO to calculate individual dose equivalent (IDE). The calculations have shown that the area with the highest level of effective doses is that located along the prevailing wind direction, i.e. SE of NPP Bohunice, at a distance of approx. 3 - 5 km; the critical age group are infants. Table 4.6.3.3. presents the results of the calculations.

Year	IDE [Sv]	
	infants	adults
1990	2,618E-5	5,439E-6
1991	1,358E-5	2,581E-6
1992	1,241E-6	3,642E-7
1993	5,038E-7	2,018E-7
1994	4,034E-7	1,410E-7
1995	1,541E-7	5,939E-8
1996	4,64E-7	1,91E-7
1997	3,71E-7	1,55E-7

The IDE values shown are substantially smaller than those received by the population from the natural background. At the NPP Bohunice area, individual dose equivalent from natural background is 100 - 10,000 times higher than values shown in the Table.

In addition to monitoring by the operator, monitoring of the environmental impact is performed by the Regulatory body (ŠZÚ).

The Slovak Center of Radiation Monitoring Network as well as the Regulatory Authority monitors integral doses intensities within a system of monitoring points in nuclear installation surroundings using TLD method. It also discontinually measures dose within a system of monitoring points in nuclear installation surroundings, monitors the activity of fission products in emissions, airborne particles, drinking water, surface and ground waters, soils, sediments, agricultural products and food products produced around nuclear installation, conducts random parallel analyses of aerosols and samples from collection tanks of waste waters before their discharge.

Slovak Center of Radiation Monitoring Network (SÚRMS) is a permanent executive unit of the Slovak Government's Commission for Radiation Accidents. It is responsible for methodological preparation of

the components of the monitoring network and for their standard procedures in monitoring the radiation status.

SÚRMS has been established at the Institute of Preventive and Clinical Medicine, Bratislava, as its integral part. The head of SÚRMS is appointed by the Commission Chairman at the suggestion of the Slovak minister of health.

In times when it has not to deal with any specific radiation accident, SÚRMS reports to the minister of health.

SÚRMS comprises the following constituents which participate in the monitoring of the radiation situation in Slovakia:

- Slovak Institute of Hydrometeorology's monitoring system
- Slovak Armed Forces' monitoring system
- monitoring system of the Slovak Ministry of Interior - Civil Defense Office
- monitoring system of the Slovak Ministry of Health
- monitoring system of NPPs

4.6.3 Activities of Regulatory Authorities

The authority responsible for health protection, is the Hygienist General of Slovakia. State Health Institute (Center of Health Protection Against Radiation)

- performs inspections,
- is responsible for training of NI employees in matters of radiation protection,
- participates on the education and information of the public,
- systematically follows the radiation load of the staff and how personal dose measurement quality is provided for,
- develops analyses of personal doses and uses them to assess the application of the ALARA principle,
- controls the system of dosimetric measurements quality,
- performs own measurements of the radiation status within the controlled zone and outside of it, in particular during reactor outages,
- performs random control measurements of the activity of discharges,
- sets conditions for removal of objects, materials and equipment from the controlled zone and for their further use,
- sets limits for release of contaminated objects and materials,
- controls the emergency preparedness in case of radiation accidents and incidents (material and human resource),
- reviews working rules, new technologies and working procedures,
- controls monitoring systems of individual doses from external irradiation and internal contamination,
- controls the system of preventive health care and of preparedness for health care in case of radiation accidents and incidents.

4.7 Emergency Preparedness

4.7.1 Emergency Preparedness Related Legislation

The legislation relating to emergency preparedness for currently includes Act No. 130/1998 Coll.II. on the peaceful use of nuclear energy and alterations and amendments to Act.No.174/1968 Coll.II on State supervision of work safety as amended by Act of National Council of the Slovak Republic No.256/1994 Coll.II. On Civil Protection of the Population, as amended from time to time, and the related supporting Decrees of the Slovak Ministry of Interior, and Act of National Council of the Slovak Republic No. 290/1996 Coll.II. which amended and supplemented Act No. 272/1994 Coll.II. On Human Health Protection as amended by act of National Council of the Slovak Republic No..222/1996 Coll.II. On Amendments and Supplements to Certain Other Acts. In addition to the above, Accident Act and Act on Integrated Rescue System are being drafted. All the above documents account for the recommendations of the International Atomic Energy Agency, Vienna:

- Safety Series 50-SG-06: Preparedness of the Operating Organization for Emergencies at NPP,
- Safety Series 50-SG-66: Preparedness of Public Authorities for Emergencies at NPP,
- Safety Series 55: Planning for Off - Site Response to Radiation Accidents in Nuclear Facilities,
- Safety Series 72. Rev. 1: Protection from Radiation Sources not under Control Accidents.
- TEC DOC 953 - Methods to Prepare for Emergency Response to Nuclear and Radiation Accidents,
- TEC DOC 955 - Basic Assessment Procedures for the Purpose of Taking Protective Measures During Reactor Accidents,
- Act No. 130/1998 Coll.II. on the peaceful use nuclear energy and alterations and amendments to Act.No.174/1968 Coll.II on State supervision of work safety as amended by Act of National Council of the Slovak Republic No.256/1994 Coll.II.
- Act No. 290/1996 Coll.II. amending and supplementing the Act of National Council of the Slovak Republic No. 272/1994 Coll.II., On the protection of human health in the wording of the Act of National Council of the Slovak Republic No. 222/1996 Coll.II. and on the amendment and supplementing of some other Acts.

4.7.2 Implementation of the Emergency-Related Legislation Preparedness

4.7.2.1 National Organization for Emergency Preparedness

To secure the taking of necessary measures to manage emergency situations of nuclear installations and measures to protect the public and the economy upon an accident with environmental impact, the national organization of emergency preparedness is split into three levels.

Level one are emergency commissions of nuclear installations the main function of which is management of works and measures within the areas of nuclear installations so as to enable the identification of the technology condition and to manage measures to cope with the emergency condition and to contain consequences with respect to the staff, equipment, environmental impact and the population.

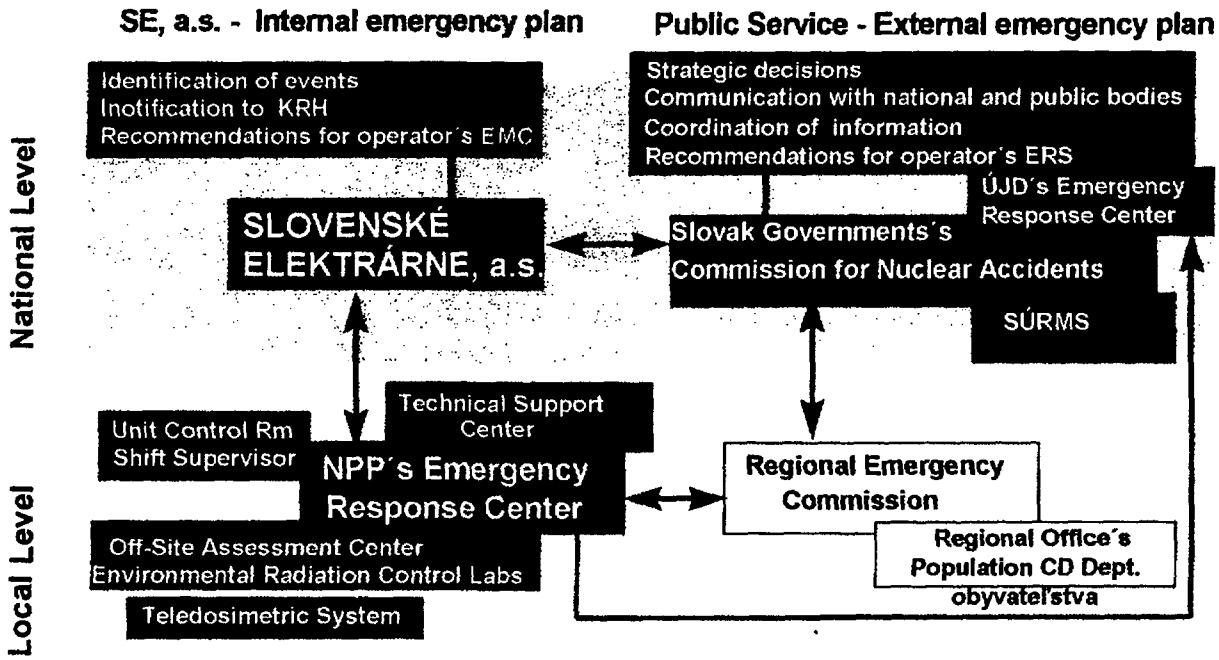
Another function of this level is provision of information to other emergency commissions on the state of the installation and on potential impact on the surrounding areas.

Level two is managed at the regional level, and comprises district and regional emergency commissions within the territory of potential risk of damage to life, health or property, and within which measures to protect the population are planned. The territory is identified as a 30 km circle around NPP Bohunice (EBO, VYZ) and 20 km around NPP Mochovce.

Level three is represented by the Slovak Government's Commission for Radiation Accidents (KRH SR) at the national level, with its expert supporting components (KKC ÚJD, OSG and SÚRMS), and by Emergency Safety Commission of SE a.s. The task of the Government's Commissions for Radiation Accidents is mainly to coordinate and to manage the preparations of measures directed towards the protection against the consequences of a radiation event. The task of the Emergency Safety Commission of SE, a.s. is mainly to organize and to coordinate a fast elimination of consequences of serious and extraordinary events in production and/or distribution plants.

- ÚJD´s Emergency Response Center is a technical support instrument of ÚJD to monitor NI operation and to evaluate its technical status and radiation status in case of a nuclear or radiation accident, and to prognose the development of the accident and its consequences, as specified by Act No. 130/1998 Coll. It at the same time serves as a support tool for OSG established within KRH.
- OSG – Operative Steering Group is an expert advisory body to KRH SR established based on the Statutes and Resolution of KRH SR. The task of OSG is to develop, based on the assessment of the actual situation in case of an NI accident, background materials and a single common recommendation by sectors involved with respect to decision-making in matters of the public protection.
- SÚRMS – Slovak Radiation Monitoring Network Center is a technical support body established at MZ SR in which data from all monitoring systems of the radiation situation in Slovakia are centrally collected and evaluated. This body was established based on the Statutes and Resolution of KRH SR.

Fig. 4.7.1 Slovak national organization of emergency preparedness



4.7.2.2 Accident Documentation

Accident documentation is kept to support the management of emergency situations at nuclear installations and their impact on the surrounding environment; it defines procedures and organization of work for the individual degrees of emergency situation at the different levels of the national emergency preparedness as described in Section 4.7.2.1.
Operator of nuclear installations has internal emergency plans developed, which define the organization of response to emergencies and its implementation concerning the management of emergency situation and staff protection including health protection of the staff included in traumatology plan. In addition, operator has to have operating instructions developed enabling the recognition and classification of the actual emergency event according to the international recommendations. At the national level, action plans of KKC ÚJD and of the Emergency and Safety Commission of SE a.s. exist (see Section 4.7.2.).
National emergency plan is currently under development it shall summarize all procedures and measures to be taken by the individual members of the Slovak Government's Commission for Radiation Accidents, and plans for the protection of the population in the potentially affected territory are developed at the regional level; they include measures with respect to the public protection, health, property and environment as well as links to internal emergency plan.

All the above mentioned plans fully apply the provisions of the national legislation (Act No. 42/94 Coll.II.) as well as international recommendations by IAEA (see Section 4.7.1.).

4.7.3 Operator's Internal Emergency Plans

Internal emergency plans and related documents have been developed so as to secure protection and preparation of employees for significant leaks of radioactive substances into the working environment and surrounding areas and for events which will require taking measures to protect the health of individuals within the nuclear installation area and those in the vicinity..

Internal emergency plan defines:

- classification system of events for assessment,
- organization structure of response to emergencies and the respective responsibilities,
- system of notification and warning of the public and NI staff,
- protective measures and methods of their implementation,
- health care measures plan,
- reconstruction principles,
- cooperating external organizations and bodies,
- system of training of staff and emergency response organization members,
- methods of education and information of the public.

The purpose is to plan and prepare organization, personnel and material and technical means and measures to successfully manage crisis and emergency situations according to the classified event; the following units are involved:

- Accident Management Center (AMC) is a workplace to coordinate OHO components activities in taking measures to relieve and contain consequences of degree 2 and 3 events. It is responsible

for the providing of information to the public, and cooperates with District Emergency Commission and external bodies and organizations.

- Technical Support Center (TSC) is a part of AMC and provides assistance to the operating staff of the unit control room in managing events classified as degree 2 or 3.
- Operation Support Center (OSC) is a part of AMC, and its activities are focused on staff protection, assessment of the radiation status, forecasting of the development, preparation and implementation of measures to be taken within the nuclear installation area.
- External Evaluation Center located outside of the nuclear installation area; it is responsible for radiation monitoring and estimates of doses around NPP, as well as for the preparation of first recommendations with respect to the public protection.

Information flows start as soon as an operation-related event occurs. The information provided to ÚJD, Slovak Energy Dispatching (SED) and subsequently also to SE a.s.'s Emergency Service.

Information on emergency situations is provided to Supervisory Authorities (ÚJD SR, ŠZÚ), SE a.s. Directorate, Slovak Radiation Monitoring Network Headquarters (SÚRMS) and emergency commissions at the regional level (district and region). Information flows on the condition of the technology and on key safety functions between NPP and KKC ÚJD SR are on-line, based on an agreement between SE a.s. and ÚJD SR.

4.7.4 Public Protection Plans (Out-Of-Site Emergency Plans)

The development of public protection plans („Public Protection Plans") for the case of an accident of a nuclear power installation is the responsibility of Regional and District Offices with the jurisdiction including an area at risk defined as an area within a distance of 30 km for o.z. SE –EBO and 20 km for o.z. SE – EMO. Municipalities located within the area at risk prepare abstracts from Population Protection Plans of the corresponding district and/or implementation documents for the implementation of the planned measures. The above mentioned Population Protection Plans develop NI operator's on-site emergency plan, who is responsible for providing to the developers of Population Protection Plans background materials on potential impacts on the area of a nuclear emergency.

Public Protection Plans developed under the coordination of the Slovak Ministry of Interior, reviewed by ÚJD and other State administration authorities, and approved by the Chief Administrator of the corresponding Regional or District Office, are submitted to the Slovak Ministry of Interior for approval.

Upon the occurrence of an emergency event of the nature of a nuclear installation event, Regional and/or District Offices provide for measures under the Population Protection Plans. For this purpose, they establish Regional Commission for Nuclear Accidents (KKRH) and District Commissions for Nuclear Accidents (OKRH) with the status of an advisory, coordination and managing body serving the Chief Administrator of the Regional and/or District Office to ensure standard preparation and implementation of measures to protect the population and the economy upon the occurrence of a nuclear event. The activities of the above mentioned commissions are headed by the Slovak Government's Commission for Nuclear Accidents which has been characterized as a managing, advisory and coordination body at the Slovak government. To prevent the risk of delay in fulfilling the tasks connected with the population protection, KKRH and OKRH and/or KHR SR are parts of the accident response organization („OHO"). Upon the occurrence of a nuclear accident with radioactive substance leakage, NI operator is responsible for warning and notification, without any undue delay, of the population within the potentially affected area, in accordance with the on-site emergency plan, Population Protection Plan, and based on an assessment of the situation with respect to technology,

the source element, the values read from the teledosimetric system, the first measurements of the radiation within the area adjacent to the NI , and the meteorological situation. State administration authorities, local governments and municipalities subsequently take care of further measures to be taken immediately, and of secondary measures, consisting of mainly iodine prophylaxis, hiding in shelters, moving the people outside of affected the area, etc. The measures mentioned concern areas affected by the nuclear event and its impacts, including areas to which the consequences of the emergency event may, according to forecasts, spread.

The preparation and implementation of suggestions concerning population protection are the responsibility of all levels of local State administration and sectors involved.

If the impacts of an emergency situation exceed the territory of a single district, Regional Office coordinates the fulfillment of tasks and measures to protect the population. If the extent of an emergency situation exceeds the territory of a single region, Slovak Government declares and terminates emergency situation for the affected area to contain the impact of the accident.

Upon the occurrence of a nuclear event, KRH SR continuously monitors the activities of KKRH, and makes decisions to support the implementation of the necessary measures of the Population Protection Plans, establishes conditions for their implementation, evaluates their efficiency, and coordinates the activities of the Regional Commissions. Similarly, KKRH coordinates the activities of the District Commissions under its jurisdiction. To this purpose, KRH SR uses the conclusions and recommendations by professional and supporting units (such as ORS, Slovak Ministry of Interior's Civil Defense Office, KKC ÚJD, SÚRMS) which, as a rule, closely cooperate with both the KKRH and the OKRH.

The monitoring and evaluation of the radiation situation in case of a nuclear event is the responsibility of SÚRMS.

4.7.5 Population and Staff Warning and Notification Systems

The population warning and notification system is based on the Act of National Council of the Slovak Republic No. 42/1994 Coll.II. on Civil Defense of the Population as amended by the Act of National Council of the Slovak Republic No. 117/1998 Coll.II. The „Agreement on Mutual Cooperation in Securing Emergency Preparedness" made between The Slovak Ministry of Interior Public Service Division's Civil Protection Office and SE, a.s. specifies the corresponding competencies of the bodies and organizations to provide for the above measure.

Public warning and body and organizations notification systems include, within a radius of 30 km around NPP Bohunice (Figs.4.7.2, 4.7.3):

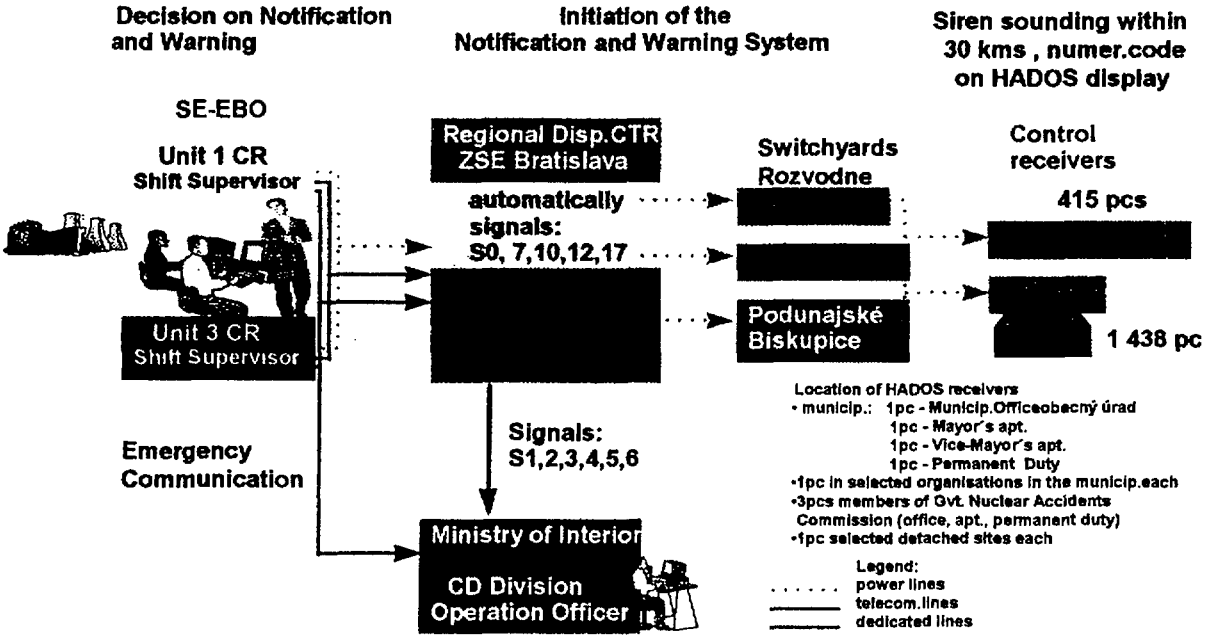
1. A system of telecommanded elements of the power system (RCC). HADOS receivers are used for notification systems which can receive 7 signals; the following signals are used: 1- imminent emergency, 2 – emergency, 3 - loss into water sources, and 7 - check. Members of emergency commissions, mayors of municipalities and towns, large enterprises and other institutions within a 30 km radius around NPP Bohunice, as well as all members of the KRH SR are equipped with such receivers, a total of approx. 1,500 receivers.

Controllable receivers HERKUL-S (a total of 419 pcs) are used for *public* warning purposes. In case of need, they can switch on rotary sirens in a 30 km radius, and can also switch sirens selectively within a selected sector.

2. A system of automated telephone calls ZU 1619 APC Zuzana; it is a computer-assisted system which can call selected organizations in the affected area.

Decisions concerning the initiation of both systems (RCC and Zuzana) are made by Shift Supervisor of the unit which caused the emergency. HADOS receivers for notification are tested twice a week. Warning system (sirens) tests are made four times a year.

Fig. 4.7.2 VVO HADOS System

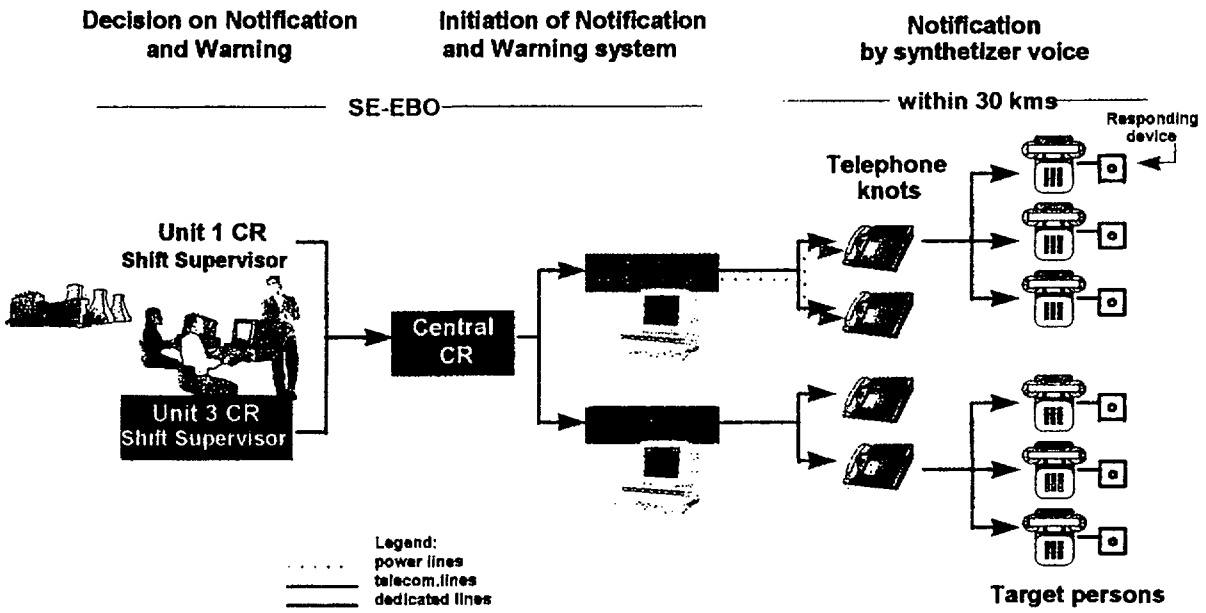


Public warning and bodies and organizations notification system within a 20 km radius around the Mochovce site comprise:

1. A warning system comprising a system of electric radio-controlled sirens in the area enabling individual or group activation and providing feedback,
2. A notification system comprising pagers for emergency teams, mayors of municipalities and towns.

Both systems are controlled from the NPP Mochovce Control Room. Decisions on the iniciation are made by Shift Supervisor.

Fig. 4.7.3 VVO ZUZANA System



4.7.6 Maintenance of Emergency Preparedness Systems

4.7.6.1 Emergency Training of SE, a.s. Staff

Staff of the branch plants SE-EBO, SE-EMO and SE-VYZ is classified into 4 categories depending on the emergency training scope:

- Category I - staff with short-term stay at NI (such as visitors, study stays etc.),
- Category II - permanent NI staff,
- Category III - OHO appointed staff,
- Category IV - Mayors of municipalities and towns located within the emergency planning zone.

The training is organized in two parts:

- theoretical training,
- practical training.

Emergency training of nuclear power plant staff is organized in the framework of training sessions according to the position hold by the trainee. Emergency training of shift crew represents a special part of the training. Emergency training is organized twice a year for each shift, so-called shift emergency training sessions. An area emergency training is organized once a year, and all employees of the respective branch plant have to participate..

Coordination emergency training represents a special type of emergency training; it is usually organized along with the area emergency training session, under the cooperation of OHK, KHK, KRH SR, KKC ÚJD and/or other OHO units (fire brigades, health care staff, armed forces, etc.). Such training sessions are organized on a regular basis, most recently in October, 1997, under the cooperation of OHK and KHK Trnava, KRH SR, KKC ÚJD, SE, a.s. Headquarters, OSG and SÚRMS.

An evaluation exercise follows the completion of the training (observers and referees), and measures are taken to improve the activities of the individual OHO units. There is a follow-up of the measures, and the management of the respective branch plant reviews their fulfilling.

4.7.7 International Agreements

4.7.7.1 Agreements to which International Atomic Energy Agency is the Depository

Slovak Republic has been the signatory of international conventions with respect to early awareness of nuclear accidents and to mutual assistance in cases of nuclear accidents; this provides for international cooperation in minimizing the consequences of nuclear accidents. The conventions mainly concern technical and organisatory measures to be taken to reduce effects of radiation on people and the environment as a result of accidents at nuclear installations.

Convention on Early Notification of a Nuclear Accidents, and Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency

Slovak Republic has notified succession to both Conventions on 10 February, 1993, effective as of January 1, 1993. The professional liability for meeting the Convention criteria is with ÚJD which at the same time is the liaison office for early notification of nuclear accidents for Slovakia. Via ÚJD, Slovak Republic regularly participates in international exercises. There has been no accident in the territory of the Slovak Republic since the effective dates of the Conventions requiring to act in accordance with the provisions of the Conventions.

4.7.7.2 Cooperation Agreements with other Countries

In agreement with Article 9 of the Convention on Early Notification of Nuclear Accidents, the Slovak Republic has been a successor to, or made bilateral agreements on early notification of nuclear accidents, on exchange of information and cooperation. The respective agreements define the format, method and the extent of information provided to the parties of the agreements on accidents connected with nuclear installations or nuclear activities, and identify contact site coordinators. The purpose of such agreements is to contribute to the minimization of risk and consequences of nuclear accidents as well as to set up a framework for bilateral cooperation and information exchange in areas of mutual interests in connection with peaceful uses of nuclear energy and protection against radiation.

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

Under this Agreement, meetings of representatives of governmental organizations of the Slovak Republic and the Republic of Austria on issues of mutual interest in areas of peaceful uses of nuclear energy are organized on a regular (annual) basis. The most recent meeting was held in 1998.

Representatives of governmental organizations of the Slovak Republic and the Republic of Austria exchange information and experience, above all in the area of preparedness for emergencies, at special expert meetings; of importance is also the participation of Austrian experts as observers in emergency exercises in the Slovak Republic.

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

Under this Agreement, meetings of governmental organizations of the Slovak Republic and the Republic of Hungary are held on an annual basis, to exchange information and experience in the field of safe uses of nuclear energy and radiation technologies. The most recent meeting was held in 1997. At the same time, cooperation in the field of emergency planning is being developed, and representatives of both parties take part in emergency exercises of the other party.

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

Under the above Agreement, regular meetings are held between experts in the field of exchange of experience from the exercise of supervisory activities aimed at securing the highest level of safety of nuclear installations and safety of handling nuclear materials; an intensive cooperation also exists in the field of emergency planning and setting up of Supervisory Authority Crisis Centers.

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

Annual meetings of representatives of governmental organizations of the Slovak Republic and Poland are held on an annual basis, aimed at exchanging information and experience from safe uses of nuclear energy and radiation technologies. The most recent meeting was held in 1997.

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

The signing of the above mentioned Agreement is expected for 1998, and its objective is specification of the format and the way of forwarding information on nuclear accidents, exchange of information and experience in the field of peaceful uses of nuclear energy, as well as strengthening of mutual trust and information level in a sensitive issue such as safety of nuclear power sector.

In addition to agreements signed with its neighboring countries, the Slovak Republic also has signed cooperation agreements in the field of peaceful uses of nuclear energy.

Agreement between the Government of the Czech and Slovak Federal Republic and the Government of the Federal Republic of Germany Regarding Issues of Common Interest in Connection with Nuclear Safety and Radiation Protection (Prague, May 30, 1990)

Even if the geopolitical situation changed after the split of the CSFR, the Agreement still applies, and the Slovak Republic meets all its commitments under this Agreement with respect to early notification of nuclear accidents and information exchange.

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

The Agreement mainly focuses on the exchange of information and experience in the field of nuclear installations safety; this is being brought about by meetings, expert training and exchange of computer software.

Arrangement between the Nuclear Regulatory Authority of the Slovak Republic (ÚJD SR) and the United States Nuclear Regulatory Commission (US NRC) for the Exchange of Technical Information and Cooperation in Nuclear Safety Matters (Washington, November 10, 1995)

The focus of the Agreement is exchange of technical information and cooperation in issues of nuclear safety which is brought about by meeting and training of experts, as well as by exchange of computer software.