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Safety of nuclear power plants in Slovak Republic in the context of integration into the European Union

Ladies and gentlemen.

Nuclear power plants belong within Slovenské Elektrárne, joint stock company, among the most reliable sources of electric energy. We can say, that they reliably provide production and delivery of electricity in required quantity and at high quality level, covering the needs of Slovak republic in the basic regime. Company management especially appreciates, that operation of our nuclear power plants is also internationally rated as being very safe and that operating personnel consists of experts with high level of safety culture. And the safety of operation of our nuclear facilities represents our highest priority, which is decisive in the process of their utilisation. And these were also the reasons for our company to invest remarkable financial means into safety enhancement of WWER type nuclear power plants.

Especially I would like to point out the fact, that since 1993 we apply Least Cost Planning methods and Financial Feasibility Analyses in the programs of productional and technological basis development, in which investment project related to safety enhancement of nuclear power plants have been included. The Least Cost Planning methods have been used to review possible variants of development and our results are in correspondence with studies of independent home and foreign institutions (for instance Tractebel, Electricité de France, Bechtel, Putnam). The basic criteria were and still are safety, environmental impact and economy. At the time, when decisions on future development of Slovak energy industry was being made, especially when question has been solved if to accomplish construction of nuclear power plant being in construction, or to make investments into new, non nuclear sources, these were the attributes, fulfilment of which company had to demonstrate not only for experts, but also for general public. Based on the Least Cost Planning method, the most optimal variant was that one, considering construction completion of first two nuclear units at our subsidiary company Mochovce Nuclear Power Plant. Based on recommendations of recognised international institutions we have implemented safety measures into the process of construction. Expert missions of International Atomic Energy Agency and RISKAUDIT have been carried out in SE-EMO, which confirmed that after implementing the additional improvements, recommended by them and approved by management of Slovenské Elektrárne, joint stock company, EMO will achieve such safety parameters, which would be comparable with modern power plants in the world. Program of NPP Mochovce safety enhancement, related to these recommendations, contained 87 technical specifications of safety measures (TSSM), divided into 4 categories. The following organisations have been chosen as the leaders - EUCOM (consortium FRAMATOME - France and SIEMENS - Germany) for 43 measures and ŠKODA Praha, a.s. for 15, ENERGOPROJEKT Praha, a.s. for 13, Russian

organisation, associated under common company ATOMENERGOEXPORT for 5, VÚJE Trnava, a.s. for 3 and remaining 8 TSSM are in competence of SE, a.s. Bratislava, which are implemented through other renowned companies, as for instance WESTINGHOUSE.

International team of experts has developed project, which meets required technical parameters and internationally acceptable safety level, confirmed by International Atomic Energy Agency. Mochovce Nuclear Power Plant is the first nuclear power plant of Russian design, constructed and put into operation in Eastern Europe, which has achieved safety level, comparable with western standards.

Construction of this power plant had to overcome distressful journey since the beginning of eighties. Its journey began by change of plant siting project, for the reason to meet requirements of former Czechoslovak Atomic Energy Commission (ČSKAE) on seismic resistance, followed by change of control system design and supplier during years 1990 till 1993. The problems continued by construction interruption within years 1993 till 1996 due to insufficient financial coverage and by a number of international assessments of safety level. All obstacles were removed in 1995, when in September was defined model of organisation and financing of construction completion of first two units, what in January 1996 enabled to initiate construction works.

From the point of view of reactors WWER 440/213 safety level, the most important for the construction completion was the fact, that these types of reactors have very good properties of passive safety and in certain aspects surpass modern "western" type pressurised water reactors. The significant contribution to high initial safety level had also replacement of original control system (designed as very progressive, however, practically unfeasible due to the component basis, available at that time within former Council of Mutual Economical Support - RVHP) by control system from SIEMENS. Very good safety features of used reactor type were known to our experts, based on experiences obtained from operation of Nuclear Power Plant in Jaslovské Bohunice and Dukovany, as well as on the basis of results of emergency states analyses, which have been already in eighties carried out by Nuclear Power Plants Research Institute Trnava, a.s. (VÚJE), using foreign codes, at a good international level. However, it was necessary to persuade international experts about these facts, as at the beginning of nineties their attitude to these types of reactors was distrusting, especially after shutting down nuclear power plant in Greifswald in former German Democratic Republic.

International assessments of safety level in Mochovce Nuclear Power Plant carried out between 1990 and 1995 by SIEMENS, EdF, IAEA and RISKAUDIT, confirmed high safety level of WWER 440/213 reactors, however, pointed out certain safety issues, which have not been solved in the project. These issues addressed mainly so called "external risks", (fire, earthquake, piping whipping, airplane crash, flooding, internally generated jet missiles, extreme meteorological conditions), solution of eventual leakage from primary to secondary circuit, ability of pressuriser safety valves to operate in steam and steam-water mixture regime. Similarly questions have been raised related to qualification of selected equipment, to design of certain safety systems and to safety analyses of emergency states. The most important safety issue was operability of containment in emergency conditions. However, conclusions of all assessments can be summarised into a general statement, that there exist no safety problems, which could not be solved and which would question power plant design as the whole.

Seismic resistance of power plant was designed at the beginning of eighties and thus did not meet recommendations of IAEA Safety Guide from 1990. Therefore seismic resistance has to be re-evaluated. As the basis for this program served conclusions of IAEA and RISKAUDIT missions. The program solved all issues resulting from them. Within the safety enhancement program also certain safety related equipment have been modernised due to their technical obsolescence. For instance, reactor protection system, incore monitoring system, radiation control equipment. These were supplies of former Soviet Union, which could not be put into operation. There have been installed modern diagnostic systems to monitor integrity of safety related equipment and established emergency control centre for the needs of emergency planning, which has not been included into the original project.

However, the most important result of safety enhancement program, important not only for NPP Mochovce, but also for all NPPs of WWER 440/213 type, is the fact, that operability of containment with passive bubbler-condenser system for pressure suppression and its acceptability from safety point of view, has been fully confirmed. Results of safety enhancement program have been re-evaluated not only by International Atomic Energy Agency, but also by other international authorities and professional organisations with positive result. Especially significant is the conclusion of RISKAUDIT, which has carried out repeated evaluation of safety level of NPP Mochovce based on PHARE project and which is accepted by European Commission. It is literally written there: "Mochovce Nuclear Power Plant is the first power plant of soviet design, constructed in countries of former Eastern Europe, which has achieved safety level comparable with western standards".

To accomplish this safety enhancement program is a quite complicated task. Erection of a nuclear power plant is a rather complex process and any suspension, even for a short period, requires the modification of technical-organisation structure. Break-up of supply system during the construction of the Nuclear Power Plant Mochovce due to erection suspension, issues related to the technology after several years of conservation, involvement of significant foreign suppliers in new political and economical conditions and extensive modifications were additional risk factors jeopardising the real commissioning schedule and date of putting the both units into operation. For instance, the contractual negotiations related to Unit 1 & 2 completion itself started in October 1995 and finished at 4.00 a.m. on 16.4.1996, the day scheduled for contract signature.

One of the most important pre-requisites needed to successfully manage the whole project was the elaboration of quality assurance procedures of plant completion and commissioning. Only clearly defined relations and responsibilities of the involved parties enabled to secure the required management quality of the whole construction. The support provided by EdF specialists was a significant contribution to this process.

The plant commissioning did not introduced any substantial technical novelties. We utilised the experiences and well-tried procedures that have been already applied at NPP Bohunice and NPP Dukovany under the direct supervision of the "Scientific management of plant start-up". This function was assured by the Research Institute of Nuclear Power Plants Trnava, a.s. authorised by the Slovak Ministry of Economy. The most important test results were clearly the containment tightness tests at both units, that showed the best results so far at this type of NPPs world-wide (about 2% at both units) indicating an excellent quality of construction. The process of NPP construction is obviously quite complex and imposes high requirements on all the involved stuff. This process was even more complex at NPP Mochovce because of the implementation of safety measures during the plant commissioning. The most important experience from this process is that a good technical background, starting

with the project and ending by working orders, is crucial for a successful completion of any modification in the project.

The total costs of two EMO units (including the deliveries performed before 1995) exceed 55.9 mld. SKK. This represents an increase against the prices that were in effect in 1995 by about 7.7 mld. SKK. Roughly a half of this increase was created by financial expenses due to a falling currency rate, inflation and increase of interest rates for credits. There was an additional increase in costs due to the fact that before starting the completion before 1995, it was impossible to precisely specify the costs for the implementation of safety measures. The price of technical solutions unknown at that time could be guessed only based on the best estimate. The project modifications targeting the safety enhancement could be prepared only once the detailed analyses of safety issues had been completed, which in most cases required to perform a quite complex thermal-hydraulic and rigidity calculations. In some cases these analyses also had to be reassessed along with additional appraisals or the proposed project modification should be rethink. All these things resulted in wider scope of supplies and in higher investment costs. This fact also affirmed us that investment into safety enhancement is a risky and costly matter.

These days the Nuclear Power Plant Mochovce generates electricity for Slovakia and represents a significant contribution to the Slovak Republic as well as to the whole region. NPP Mochovce evaluates the billions of invested crowns and offers jobs opportunities. By the implementation of all the planned safety measures, NPP Mochovce reached the highest safety level among all the WWER type plants that are in operation today. We have the similar approach to enhance the safety and reliability of NPP V-1 units at Jaslovské Bohunice. This process secured a level of nuclear safety at NPP V-1 that is acceptable on international level.

The enhancement of nuclear safety at Nuclear Power Plant V-1, achieved in the process of gradual reconstruction, required an additional and very significant investment. The high level of complexity and demands imposed during these activities represented ultimate test of skills, fitness and technical knowledge of suppliers' staff as well as the personnel at NPP V-1 which was also involved into the reconstruction activities.

The amount of electricity produced by NPP V-1 represents about 15 to 20% of the total consumption in Slovakia per year. However, the basic attribute of NPP V-1, as of the other nuclear power plants belonging to the Slovenské Elektrárne joint stock company, is safety and reliability. The whole plant operation is governed by this objective. Despite of the reconstruction activities above, the safe operation of this plant was criticised. In order to meet the criteria required on international level a number of international missions took place at this plant with the participation of experts from various important institutes well established in the field of nuclear power supervision. The recommendations proposed by these experts were materialised in number of additional measures that were implemented in frame of NPP V-1 reconstruction. This was one of the most important investment projects carried out by SE, a.s. in the near past with the aim to enhance the nuclear safety and reliability of operation of this plant in order to achieve a level of nuclear safety that is acceptable on international level.

I'd like to emphasise that the preparation activities and implementation of modernisation and safety enhancements at NPP V-1 performed in frame of the gradual reconstruction were carried out under the supervision of Slovak Nuclear Regulatory Authority, Slovak Authority of Safety at Work and other authorised Slovak supervisory bodies. Over 1200 technical improvements were implemented at NPP V-1 since the day it was put into

operation. The technical standard, level of scientific solution and know-how of these improvements meet the standard of recent knowledge and information on international level.

In June 1999, established experts from the International Atomic Energy Agency in Vienna in the Final Report of International Conference on nuclear safety enhancement in Eastern Europe regarding the WWER 440/230 reactor type, which is installed at NPP V-1, indicated that the best results in safety enhancement, namely at containment tightness, were achieved at NPP V-1 in Jaslovské Bohunice. They highly appreciated the other enhancements as well. The results of recent additional assessments carried out by the IAEA experts in Vienna also affirmed that the recommendations resulting from the international missions of experts and institutions have been successfully implemented at NPP V-1. Based on this and following the safety assessments, one can say in confidence that the nuclear equipment at NPP V-1 in Slovakia meets all the international safety requirements.

Last year our joint stock company fully satisfied its main mission - reliable and safe generation and distribution of electricity according to the instant customers demand. According to the preliminary results, that have not been audited yet, we closed the last year with a profit of three quarters of billions SKK tax included. We achieved this positive economic result at production of 26,257 TWh electricity, which represents a 12% increase against the year 1999. Moreover, the majority of this electricity was generated by nuclear power plants, which produced about 63% of total electricity generated at SE, a.s.

Because there is a discussion about the transformation of power industry in Slovakia, I would like to present some information on this issue as well. In late September of last year, the Slovak government approved the proposed transformation and the way how some segments of properties belonging to power companies should be privatised. In accordance with this decision the three state owned distribution companies shall be transformed into several joint stock companies. Three out of these new joint stock companies shall continue in electricity distribution, while 49% of assets belonging to all these new companies shall be privatised. What concerns to our joint stock company SE, the Slovak government indicated its concept of restructuring, according to which all production resources, hence the power plants, representing so far a dominant producer of electricity in Slovakia, shall remain in ownership of the Slovenské elektrárne (Slovak Power Plants). In the process of dynamic development, the transformation that take place in the Slovak power industry aims to adapt Slovakia to the standards valid in European Union. That is why it's impossible to cover all the details within this short contribution. I believe that in the time when the conference takes place, many of these issues will be resolved and I can inform my foreign colleges in more details.

Ladies and gentlemen, I thank you for attention.