DISMANTLING SUPPORT PROJECT FOR THE BOHUNICE NUCLEAR POWER PLANT UNITS 1 AND 2 (SLOVAKIA)

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The consortium formed by IBERDROLA Ingeniería y Consultoría, leading company, Électricité de France, Empresarios Agrupados, Internacional, S.A. and Soluziona Ingeniería has been awarded the decommissioning support project for the Units 1 and 2 of Bohunice V1 Nuclear Power Plant (Slovakia). The plant and the site, the activities to be developed and the main characteristics of the project are described in this paper.

INTRODUCTION

The consortium formed by **IBERDROLA Ingeniería y Consultoría**, leading company, **Électricité de France**, **Empresarios Agrupados Internacional S.A** and **Soluziona ingeniería** has been awarded the decommissioning support project for the Units 1 & 2 of Bohunice V1 Nuclear Power Plant (Slovakia).

The project is funded by the Bohunice International Decommissioning Support Fund (BIDSF) and managed by the European Bank for Reconstruction and Development (EBRD).

The scope of the works involves the following three major blocks: projects related to the shut down the two units prior to decommissioning, projects to prepare the licensing documentation for the decommissioning, and projects relat4ed to the waste management. All of them are associated with the pre-decommissioning.

The project includes the development of the conceptual engineering associated with the preliminary decommissioning projects, preparation of the requirements for contracting the detailed engineering and the final job delivery supervision, engineering and project co-ordination management, and management support to Slovenske Elektrarne a.s., the owner plant utility hereinafter called SE, during execution of these projects.

The services contracted cover the areas of planning, execution, management, coordination and tracking of all those aspects required to carry out the projects associated with pre-decommissioning, always in accordance with European and international safety legislation.

PMU (PROJECT MANAGEMENT UNIT)

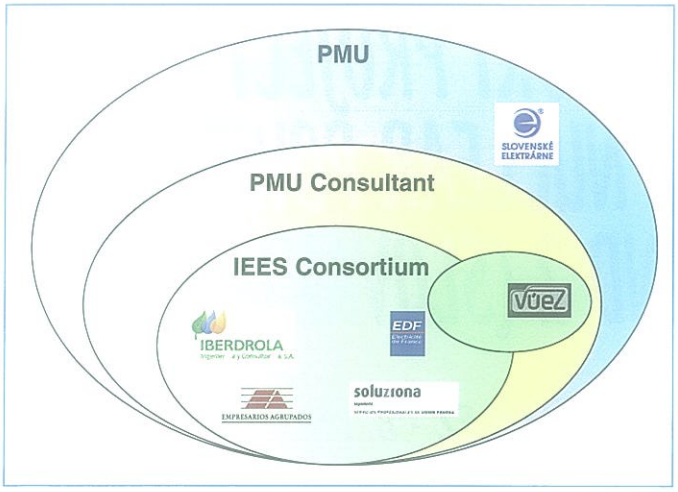
To comply with the requirements laid down by the EBRD, a Consortium (called IEES Consortium) has been formed. IEES Consortium has an extensive experience in the nuclear field and is capable of providing the services established under the terms of reference (specifications) of this Project.

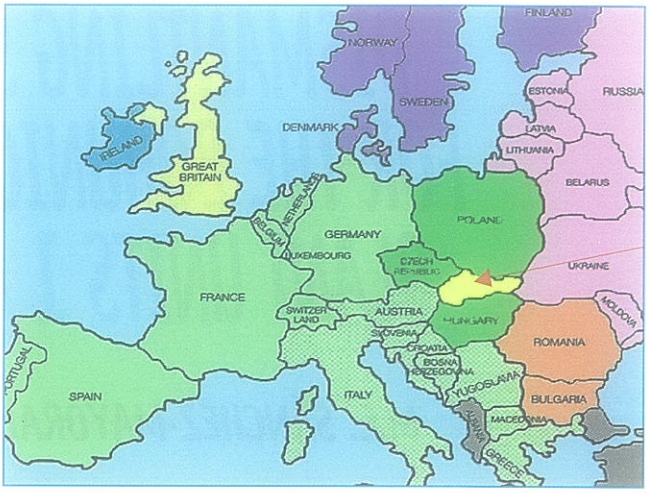
As indicated above, the companies comprised in the IEES consortium are:

- Iberdrola Ingeniería y Consultoría, S.A.U./ Spain (leading company)
- Electricité de France / France
- Empresarios Agrupados Internacional S.A. / Spain
- Soluziona Ingeniería / Spain

IEES Consortium has contracted a local engineering company, VÚEZ, in order to achieve a better development of the project, with a great experience in nuclear filed services in Slovakia and in the surroundings countries.

The main reasons for this union are the great synergy between the companies, their complementary capabilities,





the proven experience in the nuclear field and in the development and management of similar projects, and the proven methodology to undertake this type of projects, together with a good coordination acquired from joint work based on national standards and in development of international projects, in particular in Central and Eastern Europe.

This union, called PMU Consultant, join with an expert group from SE form the so-called **PMU**, Project Unit Management, which is in charge of developing the project activities.

The IEES Consortium has seven highly qualified technicians permanently on assignment in the offices created for this project and who are integrated into the Slovak PMU team for working together.

In addition, specialists from the member companies of the Consortium provides support in different disciplines, including mechanical, construction, civil, instrumentation and radiological protection; they could be temporarily working on-site if the Project requires it.

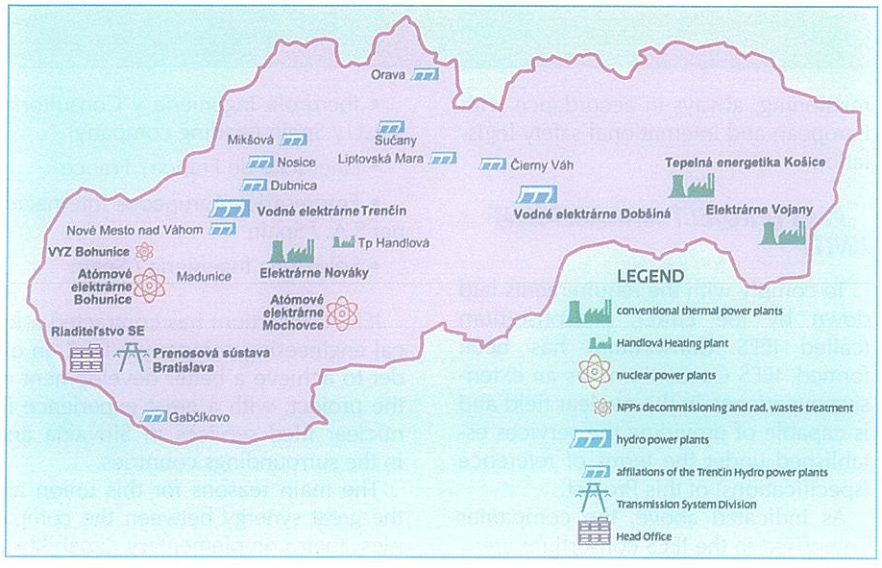
BOHUNICE NUCLEAR POWER PLANT

The Bohunice Nuclear Power Plant is located in Slovakia, near the capital of Bratislava.

Electricity is generated in two reactors at Unit called V1 NPP and in other two reactors of Unit V2 NPP. Each reactor has two turbines (220 Mw) installed.

The group 1 of Unit V1 started into operation in June 1981, and the group 2 in January of that same year. The group 3 of V2 began operating in February 1985, and the group 4 in December 1985.

Bohunice Nuclear Power Plant has the largest power generation capacity on a single site with respect to all power generation sources in the Slovak Republic.



Both groups of Unit V1 have a Soviet-design VVER 440 type, model 230 (pressurized water reactors), whereas Unit 2 groups are model 213, a modified design.

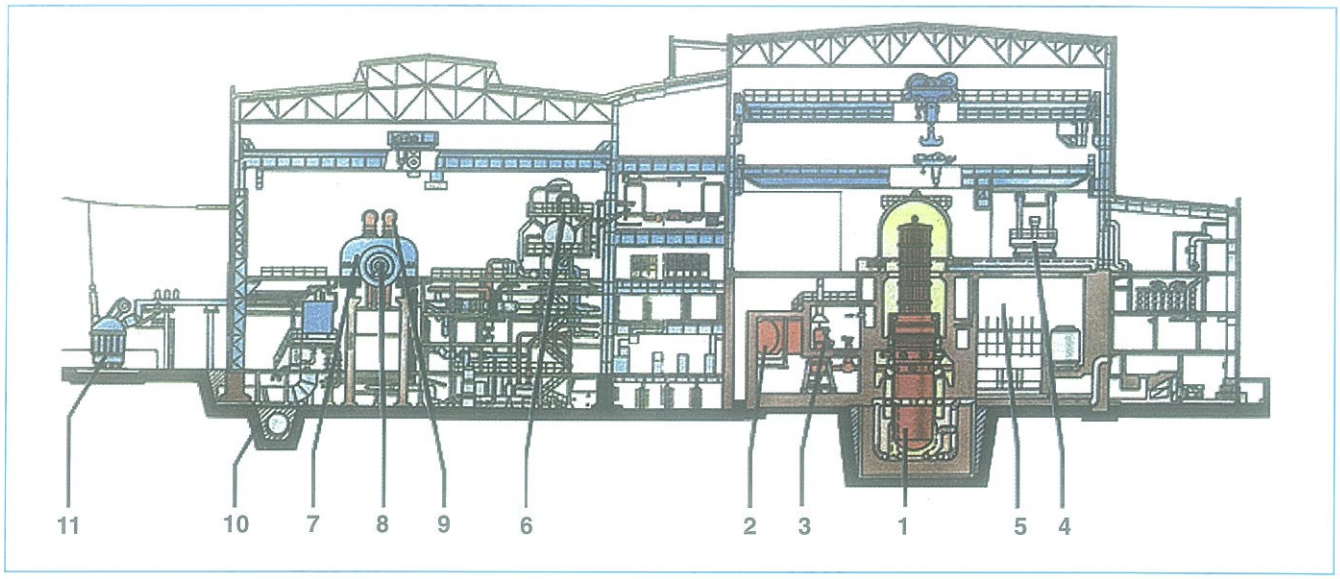
VVER-440 plants have six cooling loops that provide multiple paths for cooling the reactor, and each one has a horizontal steam generator for improving heat transfer.

They have insulation valves that allow operators to take one or more of the six coolant loops out of service while the plant continues in operation. They are able to withstand a simultaneous loss of coolant and loss of outside electric power, since the turbine directly supplies the pumps (taking advantage of inertia-driven motion).

Design 213 corresponding to Unit V2 has been improved respecting the previous model. The Accident Localization System has been enhanced with the use of a steam suppression structure. The Emergency Core Cooling System and the Auxiliary Feedwater System have been added and the reactor vessel has a stainless steel lining, among other improvements.

The reactor core is composed of 312 stationary fuel assemblies and 37 mobile assemblies (the mobile fuel assembly is loaded into the control rod drives and can be move together), with 126 control rods. In this way, the control rods are combinations of fuel assemblies and absorption extensions. VVER-440 reactor core has racks and guide mechanisms to move the control rods.

In model 213, there is a compartmented area which objective is to prevent the release of fission products to the atmosphere in case of accident. These so-called Accident Localisation Compartments have pressure valves to counteract the overpressure existing inside of them.



Legend VVER-440/230: 1. Reactor, 2. Steam generator, 3. Main circulation pump, 4. Refueling machine, 5. Cooling pond, 6. Deaerator, 7. Steam turbine, 8. Generator, 9. Steam pipelines, , 10. Cooling water pipelines, 11. Transformer.

WORK TO BE DEVELOPED FOR THE PROJECT

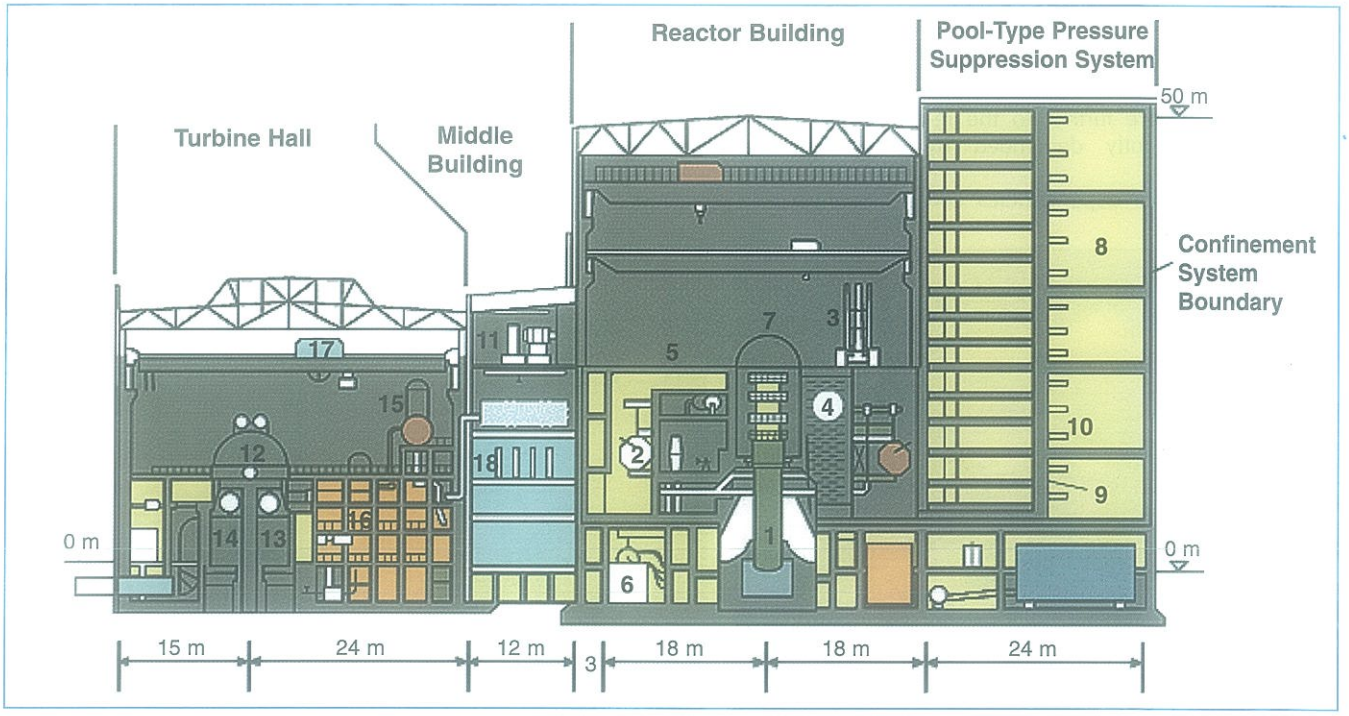
Resolution No. 801/99 enacted by the Slovak Government on September 14, 1999, called for shutdown of reactors 1 and 2 of Bohunice V1 NPP in 2006 and 2008, respectively.

The European Commission launched the initiative to establish the Bohunice International Decommissioning Support Fund (BIDSF), in order to provided SE the funds to confront the activities derived from the NPP decommission. These projects are been grouped as follow:

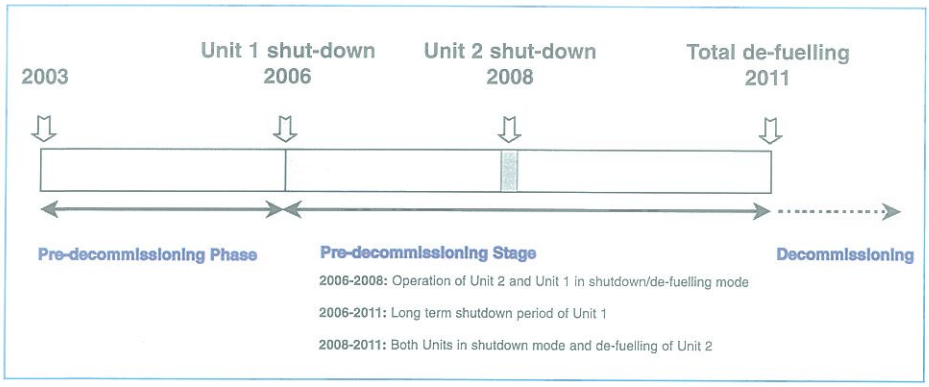
- Block A.- Projects involved in the shut down of the two reactors before their decommissioning (development of conceptual engineering, physical site modifications, updating of licensing documentation,...)

- Block B.- Projects to prepare the licensing documentation for decommissioning.

- Block C.- Waste management projects (waste treatment, conditioning and storage, including activities to enlarge the existing waste storage in Slovakia, Mochovne).



Legend VVER-440/213: 1. Reactor pressure vessel, 2. Steam generator, 3. Refueling machine, 4. Spent fuel pit, 5. Confinement system, 6. Make-up feedwater system, 7. Protective cover, 8. Confinement system, 9. Sparging system, 10. Check vales, 11. Intake air unit, 12. Turbine, 13. Condenser, 14. Turbine block, 15. Feedwater tank with degasifier, 16. Preheater, 17. Turbine hall crane, 18. Electrical instrumentation and control compartments.



Block A

The purpose of contracts activities, to develop the projects involved in the first block, is to ensure safe shutdown of groups 1 and 2 of V1 NPP, to complete the licensing process for the pre-decommissioning period, and to ensure normal operation of Unit V2 NPP and of the waste treatment and temporary fuel storage facilities existing on the site, the so-called SE-VYZ.

This will include the conceptual engineering of the plant modifications that should be made to achieve:

- Physical separation of V1 NPP reactors 1 and 2, and also from Unit V2 NPP and the SE-VYZ facilities.
- Continuity of the functions, services and utilities of V2 NPP and the SE-VYZ facilities that are currently supplied by V1 NPP and that will be off as a result of its shutdown.
- Ensure the system capabilities that are required at the beginning or during the preliminary decommissioning phase and that are further to the requirements currently demanded by normal operation.
- Elimination of dependencies and interconnections (mechanical, electrical, instrumentation, etc.) between V1 NPP, V2 NPP and the SE-VYZ facilities.

Block B

As part of the decommissioning of a nuclear power plant, a strategy must be defined and licensing documentation and associated engineering must be prepared in accordance with the legal requirements in force in the country.

The second block projects, block B, involve the documentation corresponding to project BIDSF:

- Updated Conceptual Decommissioning Plan (description of the current state of V1 NPP including systems and structures, radioactive inventory, procedures and means to be used in the decommissioning, definition of different scenarios and comparison of alternatives).
- Environmental Impact Assessment Report.
- Decommissioning Stage I Plan (waste management specific to this phase, radiation protection and surveillance, environmental impact, technical, financial and personnel provisions, new facilities, buildings or equipment, building demolition and decontamination operations, decontamination equipment, analysis of a possible emergency situation, etc.).
- Documentation database (complete equipment and building inventory, as well as radiological data and other requirements needed for decommissioning scheduling).

Block C

The projects in this block, related to waste management, are focused on reduce the radiological risks associated with the removal and processing of historical waste resulting from operation of V1 NPP and provide an on-site storage and additional capacities of storage for waste generated during the decommissioning activities.

In addition to the specific application of the best available processing and treatment techniques to each type of waste, this block includes the establishment of an overall strategy to be followed for management of waste generated during the decommissioning and historical waste.

Before processing the waste generated during the decommissioning activities, the waste that is currently stored on-site must be treated and removed. In addition, it is necessary to implement the treatment, processing, packing and storage facilities needed for the waste resulting from decommissioning that cannot be processed in the currently existing facilities due to their capacity or the kind of the waste generated.

The additional waste management techniques form part of the specific projects of this block, that currently exist in the consortium member countries,

Plasma. Treatment facility (Spain)

Plasma. CENTRACO remelting unit (FRANCE)

include volume reduction based on plasma technology, melting of metallic waste, or vitrification of sludge and absorbents.

The large volume of waste that will be generated during decommissioning requires that an increase in the current storage capacity at Mochovce (national radwaste storage) should be considered.

The main projects to be developed in each of the three blocks included in the PMU's scope of supply are identified; nevertheless, other projects that may arise during the development of the works will also be undertaken.

FUCNTIONAL GROUPS INVOLVED IN THE PROJECT AND THEIR ACTIVITIES

Engineering Services

The engineering services provide by the Consortium can be divided into three categories:

- Activities related to conceptual engineering development.
- Preparation of technical specifications to supply equipment and services.
- And supervision of the contract works following the procurement specifications.

At first, the hypotheses and bases for identify and justify the physical plant modifications or waste management technologies that must be implemented will be established. These conceptual studies guarantee technical consistency

Mochovne disposal facility (Slovak Republic)

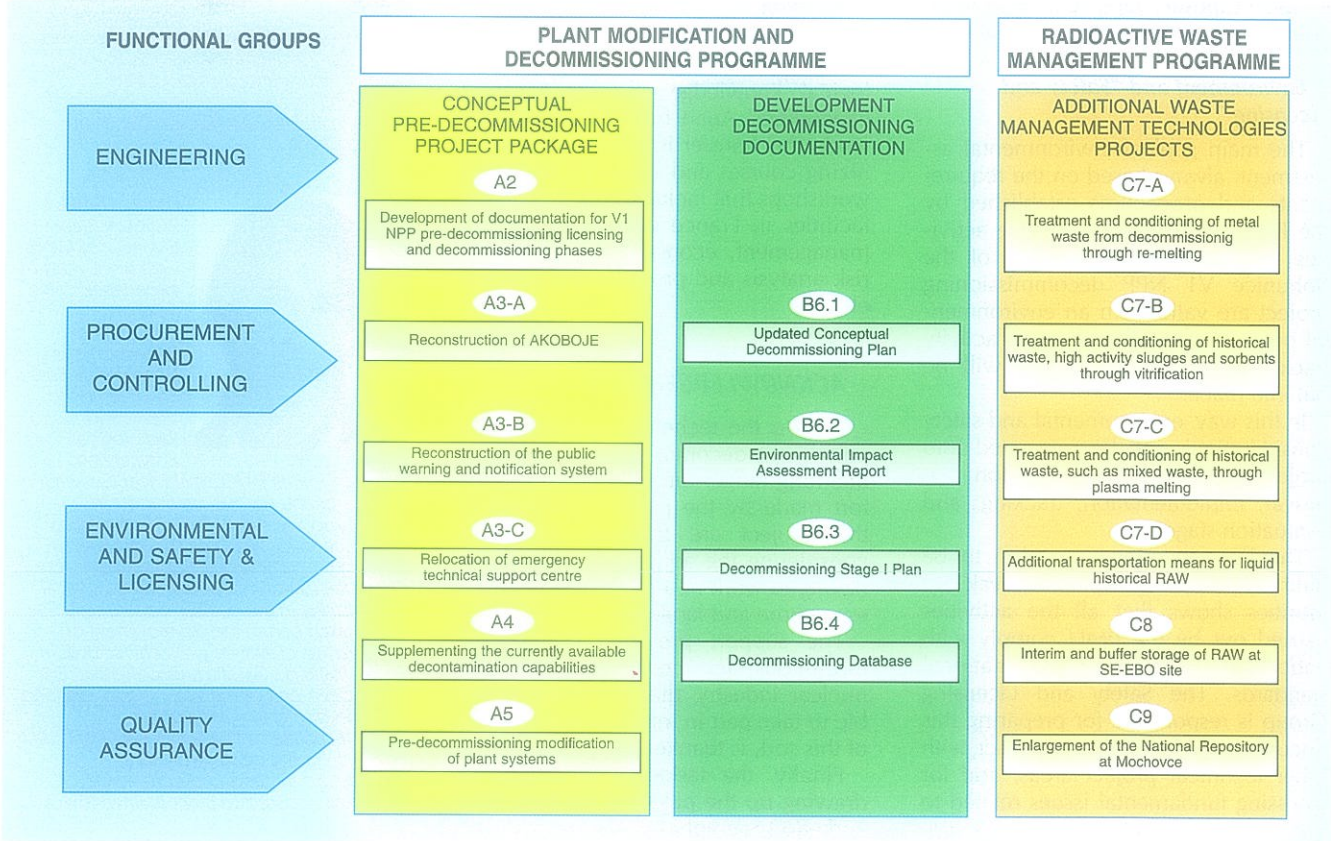
and optimisation of preliminary decommissioning project costs.

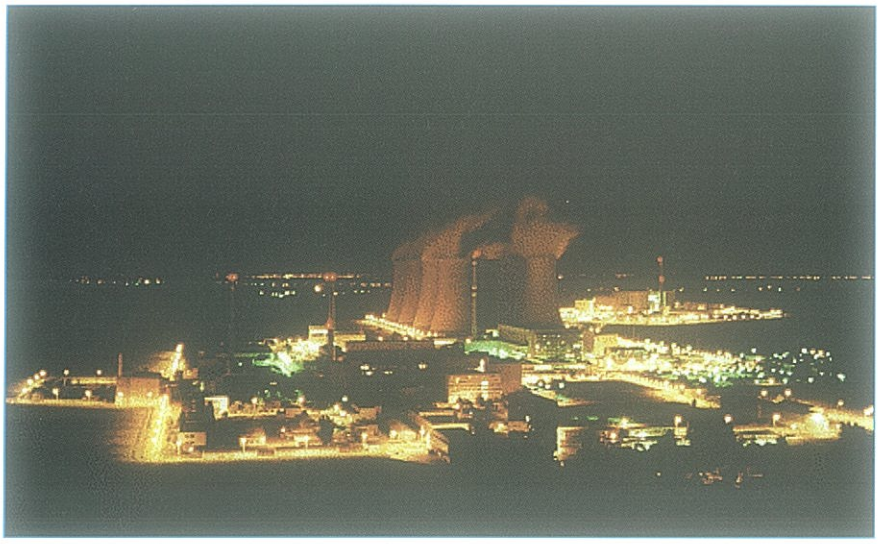
The purpose of the technical specifications is to establish the requirements for contracting the detailed engineering of the projects or the equipment and services purchase. The works will be developed by a third party.

Finally, the supervision of job execution, revision of the delivered documentation, work acceptance, and even participation, if it is required, for the preparation of the final reception report will be made to support SE.

Purchasing Management (Contract Procurement and Contract Implementation)

The tender request process for acquisition of goods and services will be





conducted in accordance with the rules established by the European Bank ("Procurement Policies and Rules for Projects Financed by the European Bank for Reconstruction and Development") and with applicable Slovak legislation.

The PMU's responsibilities include definition of procurement strategies, notification of opportunities to potential contractors, pre-qualifications, coordination of the document drafting process for the tender request including definition of the evaluation criteria, subsequent application of these criteria to the proposals received, support in contract preparation and signature.

Environment and "Safety and Licensing"

The main goal of environmental assessment, always based on the requirements and procedures established by the EBRD, is to ensure that the activities to be developed as part of the Bohunice V1 NPP decommissioning project are valid from an environmental point of view. Therefore, an activity tracking and control process will be put into place.

In this way, environmental and safety considerations will be integrated into project development, preparation, approval, implementation, tracking, and evaluation stages.

The licensing documentation to be ultimately delivered to the Slovak authorities shows that all the activities carried out by the PMU comply with national regulations and international standards. The Safety and Licensing Group is responsible for preparing this documentation, in direct contact with other technical project areas, and for assessing fundamental issues related to nuclear safety and the radiological potential impact on operators, public and environment.

Quality Assurance

The entire project is subject to a Quality Assurance System, which is compatible with SE's own system (in compliance with ISO 9001:2000 Standards), that is used by the PMU to carry out its activities, prepare reports and assess subcontractor services and their deliveries in accordance with applicable quality standards and practices.

Training

One of the most important aim of this project is an exchange of technological knowledge and management capabilities. Apart from the day-to-day work, this transfer is achieved by organizing courses and seminars, technical workshops that include visits to nuclear facilities in France and Spain, project management, economic, cost control, risk analysis and procurement courses, etc.

ACKNOWLEDGEMENTS

Due to the technical complexity involved in a decommissioning project of this long-range, the hard work and effort made by the persons involved in this project are thanked, especially considering the additional difficulty of having to work in a place with a different culture and language.

The support provided by Spanish Institutions and companies from the nuclear industry, that has made possible to take part in international projects of this sort, is thanked.

Finally, the taskforce in charge of drawing up the proposal for their time and effort is emphasised.

María Luisa SÁNCHEZ-MAYORAL VALENS graduated in Physical Sciences from the University of Valencia, where she majored in Fundamental Science, and she has a Master's in Nuclear Engineering. In 1986, she started working for UITESA in the Department of Radiological Analysis. In 1989, she was named head of UITESA's Environmental Department, which encompassed the previous department and included new businesses related to the environmental area. In 1992, she joined IBERSAIC (an Iberdrola Group environmental company) as head of the Engineering Department. In 1996, she joined Iberdrola Ingeniería (IBERINCO) in the Department of Nuclear Generation, where her functions have included Business Development and, since 1999, head of the Waste and Radiological Engineering Division, where she is responsible for seeking out new projects for the nuclear area on both national and foreign markets.

Joaquín GONZÁLEZ DELGADO. Graduated in Physical Sciences. He has 17 years of experience in the nuclear sector, in the areas of radiological protection, decontamination and dismantling. Since joining IBERINCO, he has been Project Director for different contracts in these areas. He is currently head of the Dismantling and Radiological Protection Area in IBERINCO's Nuclear Generation Department.

Beatriz LAMELA PASCUA is an Engineer of Mines with eight years of experience in the field of Radiological Protection and Licensing. A Senior Engineer in the Waste and Radiological Engineering Division of IBERINCO's Nuclear Generation Department, she has participated continuously in the area of Radiological Protection for licensing of Cofrentes NPP design modifications. She is responsible for the calculations to determine biological shieldings in the nuclear department. She has taken part in the development of numerous clearance projects for UNESA, Sta. María de Garoña and Cofrentes. She has been part of the work group assigned to the Dismantling Project for Valdecaballeros Nuclear Power Plant, Units I and II, having been involved in management tasks and commercial activities related to plant disinvestments.