Manuel IBAÑEZ is Industrial Engineer by the Politechnic University of Barcelona. His professional career began at the utility FECSA in 1973. He was the Technical Manager of ASCO NPP and from 1981 to 1986 the Operations Manager.
In 1986 he joined UNESA (Spanish utilities Association) as Nuclear Operations Coordinator and Technical Secretary of the Nuclear Energy Committee's Operations Commission. From 1990 to 1992 he worked in Atlanta (USA) as the Liasion Engineer between the Spanish Electricity Sector and the Institute of Nuclear Power Operations (INPO). He is the WANO Interface Officer with the Paris Center and the International Point of Contact with INPO and since 1993 the on-site Team Leader in South Ukraine NPP for the projects covered by the TACIS program.
He is professor at the Master of Nuclear Energy course organised by the CIEMAT and the Autonomous University of Madrid.

SPAIN IN SOUTH UKRAINE NPP

M. IBAÑEZ

INTRODUCTION

A Technical Assistance Protocol was signed between the Governments of the CIS and the Commission of the European Union (CEU) on August 2, 1991 and this was the starting point of the TACIS program. In this article, the activities described are those related to the TACIS-92/93/94 on site technical assistance to South Ukraine NPP (SUK NPP).

Within the scope of the TACIS 92 Program the CEU and the Ukrainian Authorities agreed a list of projects to be implemented at South Ukraine NPP with the aim to improve the operational safety of the plant. This part of the program is called TACIS 92 on-site activities. The total budget allocated to these projects is 4 MECU.

The European Union "utility" selected to lead this program at South Ukraine NPP was UNESA and the first contract to cover our activities was signed in July 1993 between the CEU (Mr. Pablo Benavides) and UNESA (Mr. Pedro Rivero). The projects will be implemented at SUK NPP but according to the contract UNESA is "The Consultant" and GOSKOMATOM (The Ukrainian State Committee on Nuclear Power Utilization) is the "Recipient Institution".

At present, funds to cover TACIS 93 and 94 activities have been allocated by the CEU and in the case of SUK NPP the budget available is 4 MECU/program. This means that the resources to improved the operational safety at SUK NPP through the TACIS 92/93 and 94 projects add up to 12 MECU.

To carry out the projects at SUK NPP UNESA leads the work and TRACTEBEL (Belgium) is an international partner. The

Unit 2 conrol room

opposite situation is at KALININ NPP in Russia, where TRACTEBEL is the EU-"utility" leading the on-site assistance activities and UNESA is the international partner.
Other activities have been performed at present at SUK NPP under the leadership of UNESA by the foreign utilities GKN (The Netherlands) and ENEL (Italy).
To perform the project activities UNESA has used experts from the domestic companies TECNATOM, Empresarios Agrupados and GESTEC.

SOUTH UKRAINE NPP DESCRIPTION

The site is located in the South of Ukraine on the banks of the South Bug river 350 km from Kiev.
There are three 1000 MW pressurized water reactors (type VVER-1000) in operation. A fourth unit was moth-balled in the early 90's half way through civil construction and no equipment has been installed.
The construction of the first unit began in April 1976 and the generator was synchronized to the grid in December 1982.
The second and third unit were commissioned in January 1985 and September 1989 respectively.
Units 1 and 2 are twin units with a K-1000-60/1500 rpm turbine, TVV-1000-4 generator and insolation valves in the reactor coolant system loops.
Unit 3 has a K-1000-60/3000 rpm turbine and a TVV-1000-2 generator.
All units have four reactor coolant loops with horizontal steam generators.
The containment buildings are cylindrical with spherical domes made of prestressed concrete.
The reactor core has 163 hexagonal fuel assemblies. Each fuel assembly has 312 fuel rods with stacks of sintered uranium dioxide pellets clad with zirconium alloy.
Table I shows the main plant parameters (at 100% power).

TABLE I

RCS $T/_{cold}$	288°C
RCS $T/_{hot}$	320°C
RCS pressure	160 kg/cm²
RCS flow	80,000 m³/h.
Main steam temperature	288°C
Main steam pressure	64 kg/cm²
Feedwater temperature	224°C
Feedwater flow	6,800 t/hr.

TACIS ACTIVITIES

The on-site assistance activities under the TACIS-92 program started with the first visit of the "Western experts" to SUK NPP on July 1993 and continued thereafter except an interval from beginning December 1993 to the end of February 1994.
The projects under the scope of TACIS-92 were given to the team led by UNESA described in the documents called "Terms of Reference" (TOR).
The first activity to be done was to check with the plant experts the contents of these preliminary documents, prepare the execution programs, prepare the resources needed (human plus budgetary), study the plant needs and optional projects.
The initial projects scheduled to be done at South Ukraine NPP are the following:

- Reactor Pressure Vessel in-service inspection.
- Steam generator water level and feedwater flow control.
- Automatic control of welds of the primary circuit piping.
- Instrumentation and Control modernization.

Some others have been added to these initial ones and the present situation is shown in Table II.
In the next paragraphs the activities done will be described and are limited to the TACIS-92 projects and general site assistance provided. In relation with the projects to be financed by the TACIS-93/94 budget the only activities done have been the preparation of the projects "Terms of Reference".

GENERAL SITE ASSISTANCE ACTIVITIES

The permanent presence at site of the TACIS Team Leader or his assistant allows an easy contact with Western Nuclear Power Plants, in this case with the Spanish ones.

Information and assistance on several subjects beside the specific projects has been provided to the experts of South Ukraine NPP by ASCO NPP (WANO operator to operator exchange visit), ALMARAZ NPP (TACIS-92 program to visit foreign plants), the Electrical Laboratory of IBERDROLA, S.A. and UNION-FENOSA, S.A.
Intensive work has been done to prepare a list with the most urgent safety related spare parts needed by the plant that are financed by the CEU for a total amount of 1.5 MECU. The first shipment arrived to Ukraine in October 1994.
Some assistance is provided through what we call "Short-term experts visits". The idea of these visits is to send to the site some Western experts in different specialties (Health physics, fire protection, hydraulic snubbers, chemistry, etc.) for a maximum of two weeks and one more week in their company headquarters to prepare the visit report and recommendations for the plant.

PROJECT 1. REACTOR PRESSURE VESSEL IN-SERVICE INSPECTION

The initial scope of this project was divided into the three following subprojects:

- Non-Destructive Testing Reactor Pressure Vessel In-Service Inspection (ISI).
- ISI Radiation Embrittlement Surveillance Plan.
- Reactor Pressure Vessel cladding repair provisions.

The ongoing activities belong to the first subproject and their contents can be summarized as follows:

a) Vessel stress analysis: the vessel design criteria are studied in order to establish the critical areas, acceptable crack size limits and recommendable inspection frequencies.
b) Inspection program proposal: a comparative study of standards will

TABLE II

PROJECTS TO BE PERFORMED ON THE SOUTH UKRAINE SITE

BUDGET/ TITLE	TACIS-92	TACIS-93	TACIS-94
1. Reactor Pressure Vessel in-service inspection	X	X	
2. Steam generator water level and feedwater flow control	X	X	
3. Automatic control of welds of the primary circuit puping	X	X	
4. Instrumentation and Control modernization			
Phase I			
Phase II	X	X	X
5. High voltage equipment diagnosis		X	
6. Monitoring of the primary circuit welding process		X	
7. Erosion-corrosion inspection		X	
8. Plant documentation management			X
9. Secondary water chemistry improvement			X

be made and, taking into consideration the results of the stress analysis, an ISI program proposal will be made including scope, methods and inspection frequency.

c) Indication assessment manual: this calculation and assessment tool, applied to indications exceeding the acceptable limits established in the stress analysis, will be drawn up.

The main objective of this project is to provide to SUK NPP with the appropriate Non-Destructive Test procedures, training and qualification of the plant personnel to conduct an in-service inspection of the reactor vessel (from inside) using an automatic inspection equipment (donation of the German Government to Ukraine). At the same time the results of the studies performed will allow the plants to make a proposal to the regulatory authorities to use the ASME Code Section XI for the inspection requirements (10 year inspection frequency) instead of the ex-Soviet Union standards (4 year inspection frequency), that will represent for the plants important savings and significant reduction in the personnel dose.

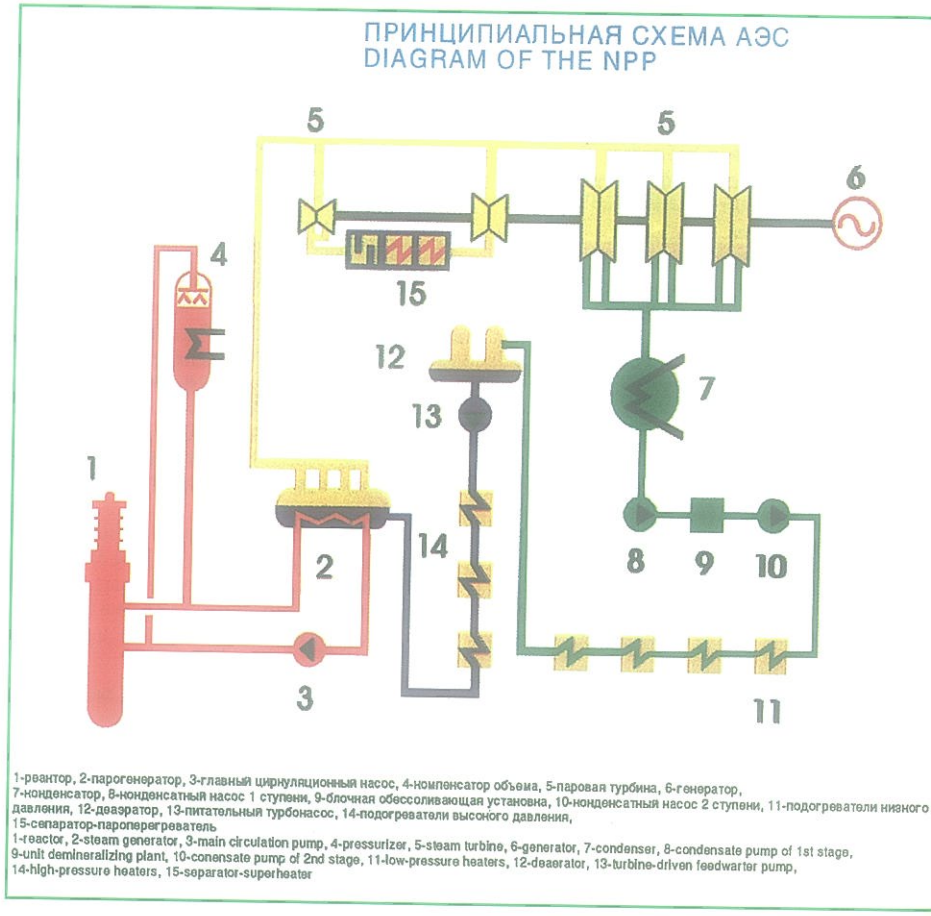
PROJECT 2. STEAM GENERATOR WATER LEVEL AND FEEDWATER FLOW CONTROL

The objective of this project is to improve the operation of the system that controls the water level on the steam generator and the feedwater flow, reducing the number of unplanned shutdowns due to the response of this control system to several plant transients.
The budget allocated to this project from TACIS-92 and 93 funds, will allow to supply to one of the units of South Ukraine NPP the following:

- A new microprocessor control system.
- Δ Pressure transmitters, thermowells, condensate pots for the SG level measurements and steam flow and steam pressure measurements.
- Feedwater control valves.

The Technical Specifications for the above mentioned supplies have been issued to initiate the open tendering process and according to the present schedule will be installed at the plant during the 1996 refueling outages.
The tasks of the project are classified in 4 main activities:

- on site activities: to obtain plant information and about the interfaces with the new equipment from all points of view (functional, lay-out, technological aspects).
- design: final specifications, bid comparison, procurement, detailed functional design, detailed drawings, etc.



Scheme. NPP

- manufacturing, installation and connection.
- testing and commissioning.

PROJECT 3. AUTOMATIC CONTROL OF PRIMARY CIRCUIT PIPING WELDS

The main objective of this project is to provide to SUK NPP with automatic equipment to inspect the welds of the primary circuit piping that will be used for the first time during the 1995 refueling outages.
The following documents have been issued and presented to the plant management:

- Primary circuit piping stress analysis.
- Primary circuit piping ISI program proposal.
- Feasibility study of primary circuit piping welds inspection program.
- Technical Specification for the manufacturing of calibration blocks.

The Technical Specification for the purchasing of the ultrasonic inspection system has been finished, approved by the General Director of SUK NPP and by GOSKOMATOM and sent to the Commission of the European Union to initiate the "open tendering process" to select the equipment supplier.

PROJECT 4. FEASIBILITY STUDY ON I&C MODERNISATION

The main objectives of this project are, with the limitation of the budget: a) to provide operational assistance to the plant in the actual state-of-the art design and on the standards applicable to the I&C systems in the Western countries and b) modernisation of the Process Computer and Information System.
The documents prepared and given to the plant are the following:

- Analysis of the I&C International Codes and standards applicable to SUK NPP.
- Post TMI requirements applicable to SUK NPP.
- Advantages of new Technologies.
- Architecture of I&C and Information System.

The main ongoing activities at the time this article is published are the variables to be monitored, information system design, hardware needed, lists of sensors, ranges, etc. related to the Technical Specification for the new Information System that is proposed to be installed at the Units 1 and 2 of SUK NPP as TACIS 93/94 plant request.
The new computer information system will include plant monitoring functions, safety parameter display functions and main equipment diagnosis