Dukovany 1/4, Czech Republic  
Mission Date; 5-22 Nov., 2001

A well developed computerized system is in place to monitor the modification process at the plant. The system includes categorisation of the modifications requests in accordance with established criteria, evaluation of each modification proposal in accordance with the plant’s strategic objectives of power plant, safety implications and other 29 criteria established to evaluate the priority of each new modification proposal. Analysis of the safety impacts, financial, manpower resources, various other parameters enables to assign the general strategy for the implementation of all the modifications in the modifications package including the "hard deadline" for the modifications implementation. The system works on-line, monitoring the flow of the entering modifications, evaluating and ranking each entry in such a way that the current priorities (safety is considered as one of highest priorities) are maintained. The system uses the PSA analysis to define the priorities of the safety related modifications dependent on their risk values.

Angra 1, Brazil  
Mission Date; 30 Jun.-17 Jul., 2003

The PST (Programação Semanal de Trabalho - "Weekly Work Scheduling") is a maintenance planning programme that uses PSA to calculate the risk rate (CDF - Core Damage Frequency) and the weekly cumulative risk (CDP - Core Damage Probability). The objective of the programme is to reduce the level of risk arising from on-line maintenance planning.

Penly, France  
Mission Date; 29 Nov.-16 Dec., 2004

An integrated verification system before unit startup has been developed at Penly NPP to capture modification tests. The system involves exhaustive listing of all required post-modification tests that have to be carried out before changing reactor condition. The related procedure is physically located inside the main control room (single binder) and in the corridor on a large poster size table. Before the outage, the operations and safety quality departments validate these tables and during post-modification tests, they are filled in real time by the testing coordinator after validation and verification of test results. The benefits of this method are as follows:
- The shift team is aware in real time of the physical status of modified equipment (and related post-modification tests)
- During outage safety meetings, it guarantees that all post-modification tests have been carried out before the operational staff is able to change reactor condition.
- The large poster-size table is strategically located in the corridor to the main control room, so everybody can have an overview of the situation at a glance. The operational staff and the Safety and Quality department are thus able to easily check changes in the reactor condition.
Brunswick, USA

Mission Date; 9-26 May, 2005

BNP has effectively managed the effect of Extended Power Uprate (EPU) and is the only US BWR to achieve the full power uprate (120% of original licensed power level). The EPU project included several modifications to ensure that operational impacts are minimized, redundancy is maintained in key BOP equipment, and transient/accident performance of some key equipment is improved over the original design.

- Fuel design to a 10x10 design provides 6-12 percent additional thermal margin, and installation of power range neutron monitoring instrumentation provides improved operational flexibility.
- The condensate system is being modified to maintain spare condensate and condensate booster pumps such that overall system reliability is not reduced.
- The feedwater pumps are being modified to significantly improve the capacity and establish scram margin in the event of a single pump trip. This scram margin for a single feedwater pump trip event was not available prior to EPU.
- The SLC (Stanby Liquid Control) system was modified to use enriched boron solution which will meet a Anticipated Transient Without Scram requirements with only one pump. Prior to power uprate, two SLC pumps were required. This has established redundancy in the SLC system and resulted in an overall reduction in Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) as a result of EPU.

Volgodonsk, Russia

Mission Date; 1-19 Oct., 2005

Information system for management of the plant modernization program. Volgodonsk NPP widely uses the information-automated system providing users technical support for development of the plant modernization program (IS KDPM). All working places and persons involved in plant modernization activities within the Concern "Rosenergoatom" have access to the IS KDPM using computer network.

The users of IS KDPM have on-line access to any detected problem description. They can comment on proposals for problem resolution and their input is entered directly into the database. All participants of the system periodically discuss problems and respective proposed resolutions. Depending on the problem level, either the Chief Engineer of NPP or the Technical Manager of Concern "Rosenergoatom" has the final decision about the final resolution of the problem.

Based on defined criteria the IS KDPM automatically calculates priority coefficients for all included problems. That greatly simplifies the decision making process. Calculation procedure of the program assures that problems connected with safe and reliable plant operation receive the highest priorities.

The information system IS KDPM prepares the final version of the annual plant Modernization plans, including schedules for financial activities, due dates for services and supplies, necessary requests according to these schedules, financial accounts for the periodically required and other necessary documentation, etc.

Experience with this system showed that modification implementation schedules could be significantly shortened using this tool. Use of modern technologies in the upgrading process of NPPs is a good practice.
Reliability and lifetime extension department.

The department on reliability and lifetime extension has been organized at SUNPP to coordinate and strengthen engineering activities in the field of application of the ageing management programme and preparation of license renewal.

- Since 2004 and in connection to establishment of reliability and the lifetime extension department, organizational measures were taken to assure data collection and work in the form of a working group (23 persons). The working group members are administratively under the home department but in direct organizational link to head of reliability and lifetime extension department.
- Working group members, being mostly part of operation departments, have access to actual data to be collected and put into reliability database. Each member of the working group has his responsibilities and duties including authorization to enter and insert data into the database. All the database activities are regulated by internal document PL.0.3108.013 defining rules and quality process including implementation of the data into "Ukrainian database of NPP’s reliability" via NAEK EnergoAtom.
- Higher effectiveness and efficiency of collection and correctness of the data put into the database after establishing the working group.

The TIGER procedure ensures that HMI (Human-Machine-Interface) design can be incorporated in modernization projects in an appropriate manner. The TIGER procedure was developed in 1998. It has subsequently been well applied to about 30 modernization projects in this plant since the start of application.

- The TIGER procedure is based upon a number of norms and guides from the nuclear industry, e.g. NUREG, IEC and ISO.
- The TIGER procedure consists of a five step procedure, e.g. TIGER extent description, present description, HMI design review, HMI verification and HMI validation.
- At the stage of present description, all the operator work tasks that are affected by the modernization are identified and analyzed by the TIGER group. Each TIGER group consists of operators and different type experts.
- At the stage of HMI design review, a new HMI design developed by technical design department is reviewed and approved by the TIGER group.
- At the stage of HMI verification, the TIGER group can be complemented by an independent person that has not been involved in earlier steps in the TIGER process, in order to achieve a more independent verification.
- At the stage of HMI validation, it is always performed by operators that have not been earlier involved in the earlier steps of the TIGER process in order to show that the modernization is in accordance with the other systems and functions within the plant.
Flamanville, France

Mission Date; 6-23 Oct., 2014

Arrangements for reducing the impact of saline mist causing corrosion in Flamanville Unit 1 and 2 pumping stations.
The pumping stations are situated in the vicinity of the sea, and as a result the equipment is surrounded by saline mist, which causes corrosion of both stainless steel and carbon steel components.
During renovation of the pumping stations, the plant installed permanent shields and movable curtains in several locations to keep saline mist away from the equipment.
These shields and curtains are made of composite materials. The movable curtains allow easy access to equipment for operation and maintenance purposes.
This decision has reduced the level of humidity and salinity in the air in areas of the pumping station, thereby reducing the rate of corrosion significantly.

Flamanville, France

Mission Date; 6-23 Oct., 2014

System for management of temporary modifications (DMPs) specific to outages.
The plant has developed a system for managing a specific type of temporary modifications (DMPs - plugs, tools and other devices mostly used during maintenance, operations and testing activities).
The system developed includes stands with shelves. Racks of suitable size for small items are placed on the shelves. Each item has its own position, and positions are color-coded.
The stands are separated by a cage, and the door of the cage is locked. A catalogue with colored pictures is placed on the outside of the cage. Every page has its own plastic sleeve, and the sleeves are easy to browse. If any item is in use, a special tag is placed in this item’s plastic sleeve.
The system allows all DMPs to be kept in strict order, enables the location of every DMP to be traced at all times, and reduces the probability of using inappropriate devices.

Paks, Hungary

Mission Date; 27 Oct.-13 Nov., 2014

Mobile battery plant

At Paks NPP the battery plant of safety systems have reached the end of their lifetime, therefore their replacement was necessary. To the replacement of the safety battery plants we had to be provided a reserve solution during the time of the reconstruction.
The electrical technical section and the electrical maintenance section have set up a container size mobile battery plant that can be moved by crane.
This mobile battery plant fulfils all the parameters of the safety battery plant at the Units and it is an equivalent substitute.
The batteries are built into a container that has temperature control, ventilation and it is seismically reinforced.
The interior of the battery plant

During the reconstruction of the unit safety battery plants was moved to the relevant Unit with a mobile crane and connected to the safety system through the connecting distributor cell of the safety battery plant. Following testing the safety system could fully operate without time limitation during which time the reconstruction works were successfully carried out.

The temporary cable

The mobile battery plant allowed the power plant to perform the reconstruction of all safety battery plants on all Units without operational safety risks.

Reserve cables and quick connection points were installed for all Units to power each safety battery plant at the designated container locations. The mobile battery plant is stored at the site of the electrical maintenance section, where periodic maintenance is provided on it. In any failure of the safety battery plant or case of a severe accident the battery plant can be set up to replace any damaged safety battery plant within 24 hours.

Technical data:
Measurements:
- length: 6000+400 mm
- width: 3600 mm
- height: 2700 mm
- weight: 22903 kg

Power source:
- network connection: 3x400/230 V 50 Hz
- built-in power: 8 kW

Batteries:
- type: VARTA Vb 2412
- nominal voltage: 220 V DC
- capacity: 1200 Ah