OSART Good Practices
OPERATIONS
Operations equipment

Ignalina, Lithuania

Mission Date; 5-21 Jun., 2006

Connection of all new computerized systems for plant performance control to upgraded (TITAN) Information system through the local INPP network.
The original design to control and test the MCR performance defined that INPP plant would be controlled and monitored not from the MCR but from the local (field) control boards. In case of changeovers and tests, the MCR operators used to receive the data of plant status from the departmental shift staff through communications facilities. Moreover the shift staff used to have to do some calculations required for the job process in the manual way. The technical support staff did not have direct access to database of the TITAN computer information system.

At present the following INPP upgraded computerized systems designed to control plant performance have been connected to TITAN Computer System through the local computer network which includes about 1200 PCs:

- Diverse Shutdown System (DSS);
- Additional Emergency Protection on ORM and Coolant Flow in GDH Reduction (in Russian"ORM AZ and GDH AZ");
- Radiation Safety Monitoring System (in Russian"SAMRB");
- Special Water Purification Monitoring System (SWPS);
- Gas Equipment Monitoring System (GE);
- Fuel Claddings Integrity Monitoring System (FCIM);
- Additional Coolant Leak Monitoring System SOT Cable-Radar;
- Automatic Turbine Control System (ATCS);
- Automatic Rotor Monitoring System (ASKR);
- Additional MCP and Turbogenerators Vibrations Monitoring System (VIBRO);
- Refueling Machine (P3M).
- Now the INPP people enable to be additionally provided with the following:

· All users are provided with data of INPP plant and system state in the common man-machine interface which has been developed for the upgraded TITAN IS;
· The INPP departmental managers, operating and maintenance personnel, technical support personnel being at their working places are provided with current data of plant and system state which they need to control and review the plant performance conditions;
· The MCR operators are provided with the data which they need to do the additional and independent control of plant state and changeovers which are controlled and monitored not from the Main Control Room;
· INPP staff are provided with archive data delivered from the TITAN data base in case of potential deviations and events to review these event and deviation causes;
· The INPP operating staff are provided with additional and processed information (namely, calculations aids like change parameter rate frequency, temperature parameters of heat exchange plant, integral parameters: water balance for a specified period of time, etc.) which the staff need to control and conduct the performance process in the proper way;
· The staff understands and is aware of the operating process in a more extended way and ensures a better communication when they conduct common performance.

South Ukraine3, Ukraine

Mission Date; 9-25 Oct., 2006

Computerized aids for operators.

The plant has developed a comprehensive set of computerised aids for operators. They complement each other and are supplied by two independent electrical trains.

During their development the plant took special care of the ergonomic part of the design. The operating personnel confirm that these systems all together are of very convenient usage.

- The computer information system (CIS) performs acquisition, processing, display, record and archiving of process parameters, safety parameters, deviation signals and control actions performed by operating personnel. The plant modernized the CIS in 2006 to enhance the design and the ergonomics. Data are available from the systems as following:
  - neutron flux monitoring equipment (NFME)
  - in-core monitoring system (IMS)
  - Radiation safety monitoring equipment (RSME).

- Safety parameter display system (SPDS) is a system which makes it possible to represent the unit safety functions status to the operator in online mode. SPDS is able to support the operator and to provide accurate information, which simplifies the accident management. Besides the main control room, the system is also available at different premises such as:
  - plant shift supervisor office
  - emergency control room,
  - internal crisis centre,
  - simulator,
  - full scope.

Furthermore the information is also available in other offices (e.g. chief engineer and deputies).

Yonggwang, Korea, Rep. of

Mission Date; 16 Apr.-3 May, 2007

Instruction Cards, placed directly on the most important equipment in the field, are used to support field operators' activities in urgent situations when the normal procedure is not available.

The instruction card describes basic equipment manipulation guidelines or a summary of the system operation procedure. Field operators can therefore promptly deal with the urgent issue and also minimize the probability of human error. On the back of the card is the equipment picture and the name and location of relevant manipulation switches and valves.

Field operators can manipulate the equipment by using the guideline card, subsequent to receive the approval of the shift supervisor. The number of cards is kept to a minimum. Currently 35 cards are used as properly controlled documentation, fully in compliance with the original procedure on the related system. Cards are made from yellow colour fire-resistant material in order to reduce the risk of a fire involving the card materials.

Chinon, France

Mission Date; 27 Nov.-14 Dec., 2007

The plant has created a programme to reduce scrams from human interface that includes labeling equipment in the field and the control room as well as electronically identifying equipment and activities that could introduce a risk of plant scrams. Over 240 items per unit have been identified for easy identification.

The plants isolation (tagging system) specifically alerts the operator that a scram risk is present when conducting isolation activities. The work order that the craftsman receives clearly identifies the potential for scram risk as well.

These activities are clearly identified on the plants daily schedule through interface with an operations supervisor that is allocated to the TEM (on-line work management) structure.

All activities that are flagged as a plant scram risk are subject to a pre-job brief for the department involved and operations. Several activities have "standardized" pre-job briefing sheets that are available for use by individuals that will be performing such risk significant maintenance.

Since the programmes inception in 2005, there have been no plant scrams due to human interface.

Dukovany, Czech

Mission Date; 6-23 Jun., 2011

The plant has developed and has been successfully using an effective digital system for recording all necessary information and activities during a shift – Electronic log book. The system allows access to all log books in different working areas at the same time and as it is connected to the plant LAN, allowing easy access for other computer users around the plant.

Some examples of positive outcomes include:

- Information from the shift about the most important activities (e. g. status, modes, and testing) ongoing at each Unit is available to the whole plant and to the local regulatory body representative.
- The system automatically generates a reminder of regular activities that are necessary to be performed in the related shift, including completion of activities as required. The system allows generation of regular and non-regular activities outside the schedule. It provides opportunity for individual data display setup.
- Effective, fast information exchange of activities performed.
- The Electronic log book is electronically connected to all requirements given by the Limiting Conditions for Operation (LCO) and this function helps to follow all modes of entering into and out of LCO. Besides this, the system counts down the time remaining till the expiry of an LCO limitation and gives a sound alarm one hour before the expiry.
- The system allows independent supervision / check of LCO adherence by the Safety Engineer (or other parties such as the regulatory body and other supervisors). It also co-operates with the PASSPORT system.

Koeberg, South Africa

Mission Date; 22 Aug.-8 Sep., 2011

Electronic Logging System of the plant

The plant implemented an integrated electronic logging system (FLIP) in March 2010. This includes all shift position logs (SM, SSS, SS, NPO, and also Chemistry, Radiation Protection and Safety Engineer) and allows groups to record and share all operational information effectively.

Examples and supporting details:

1. The logging system is LAN based and can be viewed by Management and staff promptly.
2. Operational shift staff record the Shift Log electronically and also use FLIP system for Problem Notifications.
3. Various departments use this system as an official log for daily activities. (Example Operating and Operating Support, Chemistry, Radiation protection, Chemistry, Outage Department, etc)
4. The system allows for effective transfer of information between groups and Departments.

It improves the flow of information and improves communication.

Smolensk, Russia

Mission Date; 5-22 Sep., 2011

Reactor operators are provided with a comprehensive and fast-acting information system on the reactor status, including a detailed assessment of the neutron flux in axial and radial directions.

The implementation of this complex and reliable system exemplifies a strong commitment by the plant management in support of increased operational safety.

The system includes detailed interfaces with the reactor status monitoring system to make it easy to perceive information and to carry out necessary assessments of information in stressful and time-pressed conditions. The system has the following features:

1. Two shut down systems are provided for:
   - emergency protection (AZ) – when all the rods are introduced into the core;
   - Fast power reduction (BSM) – the AZ rods stay in the upper end position, all the rest are introduced into the core.

2. There are two sets of hardware for initiation of all function modes; both sets are microprocessor based, three-channel, and independent in regards of power supply and allocation in the plant rooms (protection from common cause failure).

3. Timely display of information at the reactor operator's panels and displays, and in the rooms with this equipment that have engineering work stations to be used by operations and maintenance personnel.

4. Monitoring and protection of reactivity margin is provided. The selsyn (synchro) mimic diagram has been replaced by a video wall.

5. Active diagnostics of equipment with presentation of results at video-shots of the display system.

6. On-line display of DNB criterion in each channel with warning and emergency alarms.

Mühleberg, Switzerland

Mission Date; 8-25 Oct., 2012

Effective improvement project on component labelling system

During the OSART mission less than one month after the outage, very few labels were found missing in the plant by the team.

Four years ago a plant operator took an initiative to improve plant labeling. A new effective system was introduced. The number of labels which have to be replaced after annual outage significantly decreased from 441 labels in 2009 to 70 labels in 2012. Besides cost-effectiveness the system has also contributed to lower occupational doses, because there is a high dose rate at some places.

The improved system uses a new design of labels and new attachment technique so that labels don't need to be fixed directly to the components. The labels are attached in such a way that components can be replaced or maintained without the labels getting lost. Also the way to engrave the labels was re-examined to make them well readable and an engraving machine is used.

The new labelling system was first tested and evaluated on a sprinkler system, and following comprehensive inspections and improvements, the decision was taken to apply the new labelling system in the entire plant. The chemistry department was involved in approving the adhesives used to fix the labels. Step by step, the new labels were attached to all systems. An independent review was organized to validate the new labels using a valve checklist. To date, 95% of all labels have been replaced by the new labels.

Unambiguous identification of components in the plant leads to fewer mistakes and reduces doses and saves time during outages.

Kozloduy, Bulgaria

Mission Date; 26 Nov.-13 Dec., 2012

Emergency Control Room improvement during Instrumentation and Control refurbishment

The Emergency control room (ECR) is intended for use in case of unavailability of the main control room (MCR) for cool down of the unit then maintaining it cool and subcritical. For this purpose, according the original design, only safety system components could be monitored and controlled from this facility.

After the modernization of the normal operation control systems and their replacements by computer based systems, a Computer Information and Control System work station was installed in the ECR. Thus, the ECR operators have access to the additional operating information on the state of the unit equipment, the radiation situation on the unit and on the site, the radiation control on the discharges through vent stacks and the environment conditions in important process compartments.

The “Soft control” function of the installed work station allows control of the normal operation systems equipment, when required. This function also allows full-fledged utilization of the available equipment in all operating modes of the unit, when the access to MCR is not possible.

During normal operation the staff do not have control rights and is it used purely as an information system during regulated inspections, switch-overs and tests performed from ECR.

In an emergency situation the control of normal operating systems is enabled by entering a special access password.

The possibility for full on line monitoring and control allows performing operations which are not included in the scope of the safety systems, transfer of boron solutions, maintaining optimum water chemistry, having part load technological process therefore avoiding repetition of thermal cycles that waste valuable equipment resource.

For those NPPs which are planning to implement a refurbishment of their instrumentation and control system it might be useful to consider including the above feature into scope of refurbishment.

Kozloduy, Bulgaria

Mission Date; 26 Nov.-13 Dec., 2012

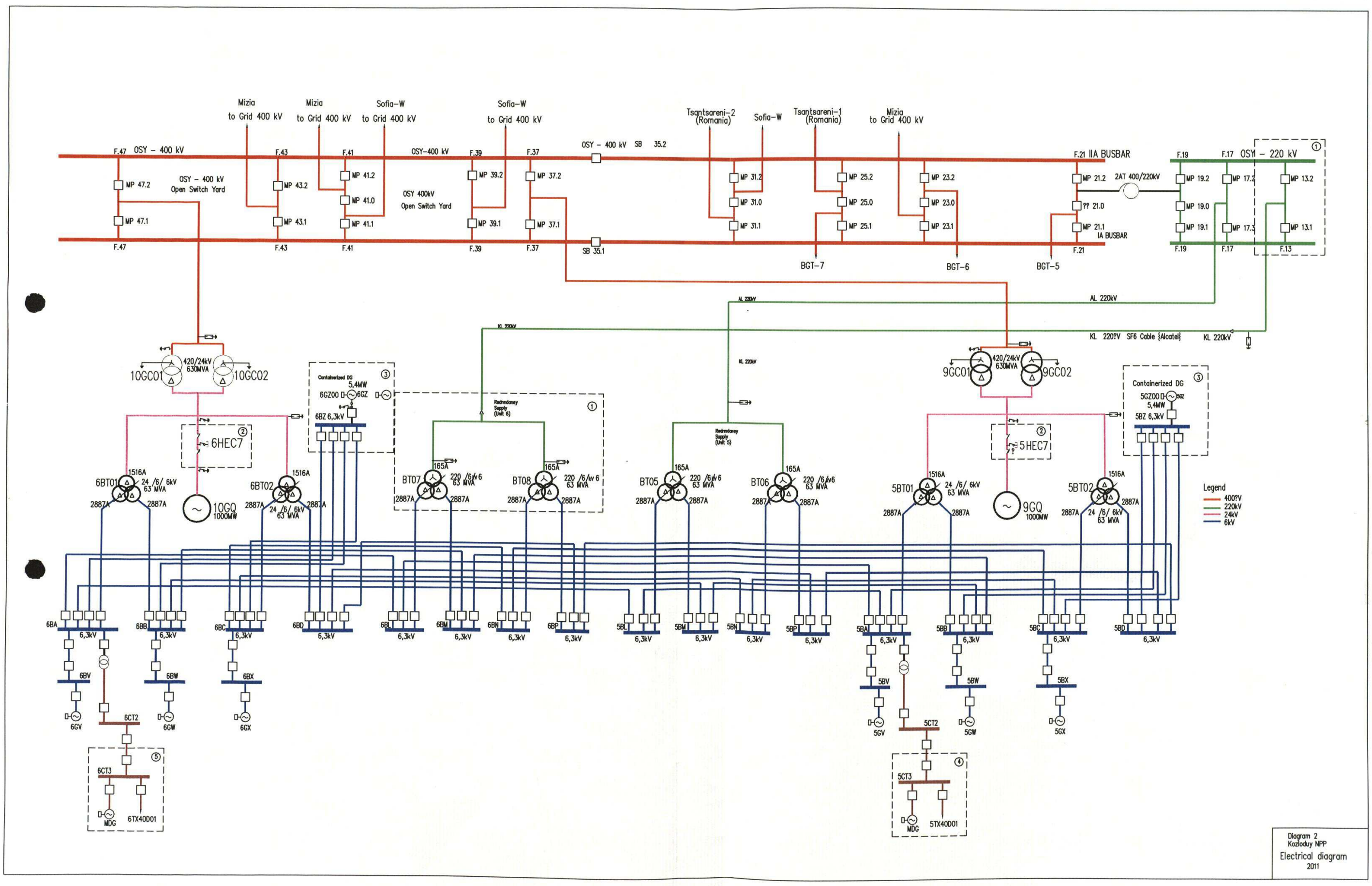
Post Fukushima plant power supply improvement – the plant developed procedures for using all possible sources of electrical power, procedures and equipment abilities were tested and validated during emergency exercise

The plant significantly improved power supply availability. Consumers power supply is provided via four 6kV buses for normal operation sections (BA, BB, BC & BD, see attached diagram). This section feeds three 6kV safety buses (BV, BW, BX). The normal power supply for 6kV buses BA, BB, BC & BD is derived from the 400kV external grid. Backup supply is from the 220kV external grid. Backup lines are connected between the two units enabling back up 6kV buses BL, BM, BN & BP to be supplied from the other units supply. During the modernization in 2003/2005 5.4 MW diesel generators (GZ) were added for each

unit. Diesel generators GZ are able to be connected automatically to the normal operation section 6kV buses BA, BB, BC & BD. In case of failure any of the 6kV safety buses (BV,BW,BX) can be supplied through normal operation 6kV buses by diesel generator GZ instead of any of safety diesel generators GV,GW,GX.
Diesel generator GZ can supply the other unit via 6kV back up lines for BL, BM, BN, BP.
On 14.5.2012 a test was carried out in Kozloduy NPP to supply the load of one of the safety buses 6kV from GZ diesel generator. This proved that during the station blackout mode diesel generator GZ can take the full load of one of the three safety systems.

Besides this test on 13.5.2011 (2 months after Fukushima emergency) Kozloduy NPP carried out a test to supply all the real load of the first category DC consumers just from battery 5EA20 of the second safety system of unit 5. This was performed to an additional procedure. During the procedure performance was tested of all emergency lighting all invertors supplied by the battery, battery current, cells voltage, temperature, electrolyse consistence, hydrogen presence in the battery room and multiple opening & closing of steam dump valves. The results indicated that the battery discharge time was more than 10 hours and 18 minutes. This test allows the operation personnel to know the real discharging time of the safety system battery and to be sure that it is enough to receive supply from another source. The discharging time is a result of the modernization programme of the UPS systems and the batteries.

The addition of this power supply provides more opportunities for securing power supplies. The test performed with real load assessed the exact capability of the supply and improved the skills of the operating personal and validated emergency procedures.



Olkiluoto, Finland

Mission Date; 27 Feb-16 Mar, 2017

Electronic plant drawings system is available to MCR and field operators.

An electronic system based on plant system drawings is available and used by plant operators in the main control room (MCR) and in the field. The system provides representations of plant isolations and clearance tagging points with permit information. The system incorporates use of large screens with touch-screen controls, tablets, and is used during pre-job briefs.

Supporting information:

- Plant drawings have been incorporated into a personnel protection permit tag-out system with visible isolation points and permit reference.
- Two large display screens with touch controls have been fitted into each of the main control rooms.
- During pre-job briefings, the licensed operators use the screen drawings to step through procedure steps. With touch controls, system areas of interest may be enlarged.
- Field operators are equipped with tablets to collect data during plant walkdowns. All P&IDs are available on the tablets.
- The system maintains use of the plant current system drawings.

Benefits:

- Provides current and clear system configuration to the shift team to ensure shared understanding during discussions and job briefs.
- The display screen design enables quick and easy P&ID selection and resizing as necessary for the specific need.
- System data and P&ID information is available to field operators to enhance parameter monitoring and configuration control.