

OSART Good Practices
TECHNICAL SUPPORT
Computer Applications Important to Safety

Paks 1/4, Hungary

Mission Date; 8-25 October, 2001

Participation of the Simulator Section in plant modifications as a testing environment significantly contributes to the success of the modifications.

In the refurbishment of the reactor protection system (RPS) in cooperation with the vendor, the simulator played significant role in the design of RPS with provision of a representative configuration. This new RPS attached to the full-scope simulator allowed for an exclusive test environment., which had a double direction, searching and fixing eventual logistic errors in the RPS and the full-scope validation prior to its commissioning as well as upgrading the simulator in parallel. On this way it was possible to reduce the failure during the implementation in the plant.

Krsko, Slovenia

Mission Date; 20 Oct. 6 Nov., 2003

Plant specific Simulator with capability to realistically simulate Severe Accident scenarios. In the conception of the project of the Krsko plant specific Simulator it was decided to include the capability of simulation of Severe Accident conditions. This was a pioneering initiative developed together with CAE, FAI and EPRI. Starting from generic W SAMGs , the severe accident scenarios specific for Krsko were established based on the most probable core melt sequences identified in Krsko level 1 PSA and evaluated utilizing the MAAP code. The MAAP model was incorporated into the Simulator modeling. In case severe accident conditions are reached in the simulation, the Design Basis reactor core, RCS and containment models are replaced by the corresponding MAAP models. The resulting simulations are plant specific and reproduce within the uncertainties of the model, the Krsko plant behavior in case of Severe accident conditions. These simulations are used for EP exercises, Operator training on SAMG guidelines and SAMG review and validation

Comprehensive information management system allow direct and easy access at the workplace, to all the data needed for day to day operation, maintenance, design changes, business applications as well as Industry operating experience through MIS direct connection to INPO, WANO databases.

The Krsko Computer System comprises two main parts: the Process Computer System (PCS) which gathers and process the plant technical information and an ORACLE based plant Management Information System(MIS), which contains the plant databases (f.i. Master Equipment Computer List), all the plant business applications, connection to external databases and the plant Intranet. The PCS and the MIS are connected through a firewall; the only allowed direction of data transfer is from PCS to MIS.

By accessing the MIS the user has available on screen the PCS information (f.i.on line plant process computer, environmental monitoring data, loose parts and vibration monitoring data, core monitoring data from BEACON, chemistry data from the CHEMNET application, etc) as well as the above referred information contained and/or processed through the MIS. Some examples of use and applications are given below:

- Outage online activities planning, WO, projects planning (PRIMAVERA);
- Follow up of Surveillance Schedule as well as recording of data from Operations Surveillance procedures, trending it for use as input to System Health Monitoring reports, surveillance follow up reports, etc;
- Preparation and follow up of procurement packages and design modification packages;
- Plant status data (f.i. critical safety functions and plant status) monitored in Main Control Room is also available in TSC, OSC and EOF. Similar data from the plant full scale simulator can also be made available in these emergency centers. This makes it possible during an exercise to make plant status presentation of a scenario, using the simulator as the scenario generator, very alike the real situation;
- User friendly, computer based process for Corrective Action Program, where all plant deviations to quality are identified in one system. The system review function routes the deviation to the proper supporting plant process to correct the adverse condition (WO, engineering analysis, etc.). The process makes it easy for workers to enter conditions adverse to quality and is based on the best international paractice.

Industry operating experience is made easily available to all plant personnel for use in work planning, prejob briefings, training lesson plans, and department meetings.

Every plant PC have direct connection to WANO, INPO and others databases through the Plant MIS through a special "tunnel" connection.

Availability of these documents encourages personnel to keep aware of industry operating experience and performance data, and provides an easily accessible source of industry guidelines that can be used to improve performance.

Volgodonsk, Russia

Mission Date; 1-19 October, 2005

A one way on line technological data transmission system which is connected to other networks for wide use and which minimizes the burden of information requests on the control room staff.

The program STARGAZER was developed in 2001. The program provides users of the local computer network with on-line technological data (analog and discrete values in the same volume as used in the plant information system). The program users are:

Administrative-technical managers of NPP;

Heads and specialists involved in plant operation: Reactor, Turbine, Electric, Instrumentation & Control, Chemical, Ventilation & Conditioning, Centralized Maintenance, Inspection Department, Safety & Reliability Control, Nuclear Safety, Equipment Testing & Adjustment, Civil Defense and Emergency Planning, Plant Shift Supervisor, Unit Shift Supervisor.

The program at Volgodonsk NPP allows on-line tracking of technological data of Unit 1, including their visual presentation in the form of data screens, charts, diagrams. Not only specialists of Volgodonsk NPP, but also those of Crisis Centre at Concern "Rosenergoatom", Crisis Centre at Minatom RF and Technical Support Center (OKB "Gidropress") can use the STARGAZER system.

The program ensures access to on-line unit technological data for remote users of http-protocol via the Internet and Radio Ethernet. The server part of the program complex for remote access to process information is installed on the server of the NPP local computer system. Remote access to the process information of Unit 1, Volgodonsk NPP, is possible only for registered users after the simultaneous authentication of both the user and the computer. The system functions in "one way", what means that any effects from the local computer network on the unit computer system are excluded.

Loviisa, Finland

Mission Date; 3-21 Aug, 2007

Usage of portable process simulator for closed loop testing at the supplier's premises.

Simulators are extensively used to support the safe and economical renewal of the automation systems in the plant. In addition to the simulators supporting development, engineering and training, a portable process simulator was also developed. This latter simulator is installed in the laboratory of the manufacturer and connected to the new automation systems important to safety for test purposes. In this test environment a real time closed loop testing is facilitated as a part of the Factory Acceptance Tests. This configuration at the factory supports testing of the safety related systems during normal operational manoeuvres and facilitates testing of the new operational procedures, as well.

Transient tests in the test environment can be also used to prove the dynamic behaviours of the new system, therefore the scope of dynamic system tests on-site can be significantly reduced.

The process simulator has been already used for testing the non safety instrumentation and resulted in several functional findings, which had not been discovered during the open loop.

A single database called THEMIS has been created in order to centralize all information to support the surveillance programme. It contains all the legal requirements (Safety report, ASME, etc), insurance requirements, maintenance requirements including manufacturers' prescriptions, requirements linked to various certificates (ISO, etc) and operating experience. Searches in the database structure can be performed by type of equipment and by type of requirement. All requirements applicable to the equipment concerned can be consulted online. Moreover, a link to Systems Applications and Products (SAP) gives access to the list of periodic tasks performed on specific equipment.

This database is a support tool, which helps to analyzing the requirements related to specific equipment and allows easy access to the highest-level requirement. Software development (material & people) is inexpensive compared to the benefits.

The main benefits are significant time savings for engineers when performing equipment analyses thanks to quick and easy access to relevant data and cost savings due to reduced need to outsource analyses. The database also supports in safety decision-making through automatic access to the most restrictive requirement.

Application of a zone model for the security of computer and digital based I&C systems

It is sensible to provide staged protection of computer and digital based I&C systems. The stages take into account the potential risk and threats depending on the system relevance to safety. One practical solution of a graded approach is to divide the computer and digital I&C systems into zones, where graded protection principles can be applied to each zone depending on its relevancy to safety or plant operations. A zone model makes it easier to apply similar protection needs in a complex computer infrastructure and at the same time facilitate the exchange of information in a safe way. The zone model makes it possible to define zone-specific guidelines depending on the protection needs.

At Neckarwestheim Nuclear Power Plant, a zone model to structure the computer and I&C based systems have been implemented together with the necessary and relevant criteria.

The defined computer security zones comprise computers with the same or similar importance concerning safe operation of the plant. Systems belonging to one zone have comparable demands of safeguards. Different computer systems belonging to one zone build a trusted area for internal communication. Zone borders require decoupling mechanisms for data flow in order to prevent un-allowed access or errors to propagate from a zone with lower requirements to a zone with higher demands, for example from the plant IT-system (zone 3) to the process computer (zone 2). Furthermore, demands for physical separation may be applied when defining zone boundaries. This method assures a further deepening of the barrier function and "defense in depth".

Zones can be partitioned into sub-zones to improve the configuration in order to demarcate one area from another functionally, or to meet different protection needs within one zone.

The zone model easily offers possibility to assign responsibilities to personnel. At the Neckarwestheim NPP responsibility for the security within a zone is allocated to individual department heads. The responsible person manages and organizes all activities concerning computer security within a zone. In addition to that the plant has appointed a computer system security officer (CSSO) who is responsible for the zone model as such. The CSSO documents the zone requirements, advises and supports all those involved and encourages the cross-departmental exchange of information about IT security in general.

Plant Data Server enhances monitoring and trending capabilities.

Site developed software has enabled ANO to maintain consistent high availability and reliability from its plant process computer systems. Developing software on-site has proven very cost effective by maximizing process efficiency and minimizing reliance on and costs paid to vendors.

One of these on-site developed systems is the Plant Data Server (PDS). This computer system enables real-time access of plant data to all plant personnel, including remote access from home. PDS is used to publish data from each unit's Plant Monitoring Computer, along with other data sources, and provides information in a consistent format directly to the desktop. Integrated performance monitoring features (workspaces for customizing trends), links to other performance monitoring documents, enhanced trending tools, tools for easier transient analysis, multi-cycle archives, and a mechanism to annotate plant data events are just a few of the benefits provided by this system.

The data acquisition high level of fidelity allows early identification of very small parameter changes. PDS utilizes an in-house developed data historian that does complete archiving of all data in a high resolution mode. All historical data is available at all times, along with real time data, to facilitate diagnostics of plant problems.

The PDS client is a standard component on the Entergy Nuclear computer desktop and provides a rich set of graphical tools. These tools assist in operations, monitoring transient evolutions, plant maintenance and diagnostics, and performance monitoring. In addition to plant computer data from each unit, PDS also integrates data from the SPDS (Safety Parameter Display System) for each unit, data from the RCP Vibration Monitoring System, WinCDMS (chemistry data), and eSOMS data (operator log readings). Data from any or all of these disparate data sources can be trended together to give plant personnel a powerful data set for analysis.

A notification system is also included in PDS. This enables anyone to be notified by email or pager when any parameter reaches a specified value.

Leveraging wireless technology to enhance plant operations.

A site-wide wireless network (WLAN) has been installed and leveraged to enhance worker effectiveness and productivity at Arkansas Nuclear One.

While wireless networking in itself is not unique, the techniques and extent to which it has been leveraged at ANO is currently at a good level. Also superior to the ANO WLAN implementation is the high standards of reliability and security. The WLAN enables usage of all the benefits gained by networked global applications in areas that were previously without network connectivity; in particular, within the power block of the nuclear unit itself. Once the enabling technology was placed in the hands of very innovative people in line organizations, use of it to bring new solutions to old problems flourished.

Operations, Chemistry & Engineering personnel have leveraged the wireless network in several areas to improve productivity and quality of operations. It provides personnel with real-time plant monitoring for local evolutions, wireless camera monitoring of remote plant areas, and use of a "Pocket PDS" client and other mobility tools on their wireless PDA's.

For Radiation Protection, the wireless network has been the impetus for process productivity and quality enhancement, such as direct entry and update of survey data.

Wireless cameras provide quick setup for monitoring high radiation areas; the cameras enable personnel to remain in low dose areas, while monitoring activities.

Maintenance & Outage Management personnel have also leveraged this technology for productivity gains. Wireless VIPER valve actuator testers are used for MOV/AOV testing, and immediate feedback to MOV engineers. Maintenance personnel can access all current reference library material in the field. Also, I&C utilizes wireless PDS in the field to reduce resources needed for string checks.

Management personnel have adopted wireless Tablet PC's as the form factor of choice, and the site-wide wireless network enables them to be in the field while still being constantly connected to online resources and corporate applications.

Security personnel utilize the wireless network in innovative solutions to everyday use, including the Positive Identification System (PIDS) system to photo-verify individuals at access check points, use of ad-hoc local access control at security doors, and wireless pan/tilt/zoom cameras for ad-hoc security monitoring.

Training has also leveraged the wireless network to cut costs and improve the training environment. Trainees have online access to lesson plans, system training manuals, and other classroom reference material.