# OSART Good Practices
## MAINTENANCE
### Outage management

## Mochovce, Slovakia

Mission Date; 4-20 Sep., 2006

Transparent control of the EMO unit outages during preparation and implementation of outage.

Responsible personnel have been assigned to each level of outage preparation and outage implementation. For effective management, 5 areas have been created: primary circuit, secondary circuit, electrical equipment, I&C system and fuel reloading, with responsible heads of departments. The control system is fully supported by planning Primavera SW and the ARSOZ control system. The control is implemented as following:

A. Outage preparation

Outage schedule is divided into 4 control levels

1. schedule of all outage tasks (app. 30 tasks per outage)
2. task of the outage; to each task, relevant Safety Orders are appointed
3. Safety Orders levels; to each Safety Order, relevant Work Orders are appointed
4. all-profession Work Orders; to each Work Order, separate operations of maintenance response are appointed

B. Outage implementation

During implementation, the main purpose of outage management is to perform work according to the approved task schedule. This can be achieved by the following operative control structure:

- Chief of outage and heads of coordination groups are responsible for schedule implementation for all of the tasks— level 1 control
- Task leader manages coordinators of safety orders in charge of tasks- level 2 control
- Safety orders coordinator manages maintenance foremen who perform works within the relevant securing order -– level 3 control
- Maintenance foreman manages works at all-profession work order- level 4 control

The above-stated process enables the plant to:

1. effectively solve issues on each level of management level
2. in case of a deviation that could cause change in planned scope, time, mode, quality, etc., the deviation will quickly get to the control level where it can be effectively solved
3. have early information on issues, from the lowest to the highest level of schedule.

## Chinon, France

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

Integrated outage risk significant activities schedule.

Effective risk management in the preparation and in the schedules of outages:

- In the area of operational safety, the outage activities schedule presents operational limits and conditions (OLC) classified by type, in chronological order, on the shutdown unit and the twin unit. The schedule is thus an accurate and "dynamic" snapshot of all current or imminent events. Also, the operational safety schedule is enhanced by the operational safety risks schedule. This document sets out the various operational safety risks likely to be encountered at various stages of the schedule; the specific conditions for carrying out activities, enhanced by lessons learned in previous years, can thus be found.

- With a view to reducing errors related to the Corporate Alert Code (CNA), activities which could trigger the CNA are given in a specific schedule. This shows the status of CNA inhibition signals or activities which will trigger a CNA, over time.

- There is a reactor building gas or iodine risk schedule. This schedule draws the reactor building coordinator's attention to sensitive risk-related operations in this area. This document is used by the area supervisor in charge of the reactor building to draw up his coordination plan.
- The outage activities schedule displays also a schedule of radiography surveys. All gamma surveys are scheduled and there is an overall schedule for these surveys. This document is used by the area supervisor and the current reactor building coordinator to give information on and to monitor ongoing or scheduled surveys. It is used by the Deputy Project Manager in charge of identifying interfaces between gamma radiography surveys and other maintenance or operations activities. The radiography survey schedule is also a very effective means of providing information to relevant NPP personnel.
- Finally there is a schedule for risks of interruption of the service compressed air distribution system. This shows all activities which could interrupt the reactor building working air supply. It is used by the reactor building coordinator and maintenance crafts whose activities require non autonomous breathing equipment.

These different schedules are discussed daily in risk significant activity meetings.

## Arkansas, USA

Mission Date; 15 Jun.-2 Jul., 2008

The plant implementation of pre-outage preparation milestones results in more thorough disciplined planning of refueling and un-planned outages. Thorough preparation facilitates executing the outage in a controlled fashion.

The plant utilizes the milestones to ensure sufficient actions are taken to execute safe and efficient outages. The process consists of 67 milestones that provide the preparation sequence. The milestones include the provision for key performance indicators that are reviewed for current status and to identify additional help or contingencies. Key milestones include:

- Engineering modifications complete
- Regulatory body approval
- Industrial safety plans finalized
- Radiation exposure estimate finalized
- Budget approved
- Work scope freezed
- Work order planning complete
- Resources (workforce, materials) available on site
- Training complete, etc.

The fleet procedure that governs the milestone process is EN-OU-100 (Refueling Outage Preparation and Milestones).

The benefit of rigorous compliance to the milestones includes:

- Improved safety for refueling outages,
- Improved industrial safety performance,
- Improved Radiation Protection planning and execution, etc.

Additional benefits are the improvement of communication and preparation between fleet management, plant management, contractors and the plant staff. Management is fully engaged and supports the EN-OU-100 milestone process. This process forces organizational alignment.

## Cruas, France

Mission Date; 24 Nov.-11 Dec., 2008

Draining the reactor by installing a plunge tube, equipped with a submersible pump through the dummy reactor vessel head.

During draining of the reactor vessel, the reactor coolant pump drain line was previously used after the residual heat removal pump is stopped, and it takes about 18 hours to drain down.

Because of the difficulty of determining precise water level control of the reactor vessel, it sometimes affects the performance of the radiographic testing on the main coolant piping when the water level becomes higher thus inducing an unexpected inflow into the piping and could result in a higher radiation environment than expected when the water level becomes lower.

By installing the plunge tube internally equipped with a submersible pump and a strainer through the dummy vessel head, it enables the level of the reactor vessel to be reduced to the desired level (100mm below the main coolant piping) and the duration of the drain down is reduced to about three hours.

Therefore, it contributes to:

- Reduction of outage duration (15hours/outage)
- Non destructive testing of main coolant piping is no longer affected
- Reduction of the radiation dose

## St. Alban, France

Mission Date; 20 Sep.-6 Oct., 2010

Nuclear Safety Guidelines for outages.

The plant has a guideline which has been specially prepared for each outage by the Outage Nuclear Safety Engineer. This guideline indicates various risks and potential nuclear safety issues, recalling traps to be avoided in terms of nuclear safety, and includes relevant operating experience feed-back.

The guideline contains:
1. Purpose, scope, etc;
2. Characteristics of the outage;
3. Objectives of the outage in terms of nuclear safety and industrial safety analysis;
4. Main work activities and modifications to be carried out;
5. Identification of works which need authorised movement of equipment above the reactor;
6. The different reactor conditions and a summary of related Technical Specifications.

Nuclear safety guidelines for the outage:
1. General Operation Rules updated since the last outage;
2. Required interface with the regulator;
3. Temporary modification request;

Previous OE St Alban and across the fleet:
1. Events which occurred in St Alban and across the fleet;
2. Troubleshooting for recurrent issues related to the application of the guidelines.

The document gives all stakeholders the same level of information. It is distributed to the plant top management, heads of department, outage engineers, project managers and the outage manager. This document is used in the outage safety meeting to prepare for outages and it is presented to Operations, Shift Managers, Shift Supervisors, Tagging Officer, MCR Operators and Field Operators. The objective of the guideline is to increase awareness of all personnel who are involved in carrying out the outage about the nuclear safety aspects.

## Flamanville, France

Mission Date; 6-23 Oct., 2014

Preparation and implementation of operational countermeasures to ensure first-time successful execution of high-risk tasks

The plant uses a CARDEN* methodology that consists of a set of tools to identify expectations and initial conditions required for successful execution of high-risk tasks during outages. This initiative is coordinated by the trade section responsible for the task; all preparations must be validated by both the sub-project manager and the outage project manager through a review.

During the outage, the coordinator who prepared the review must then coordinate all the different actions that will ensure the task is carried out safely. The coordinator uses an aid, that summarises all the stages and hold points that need to be validated.

These requirements are recorded in a tracking document DSI CARDEN.

* CARDEN = Coordinateur Activite Reperee Dimensionnante ou a Enjeux Notable = Coordinator of critical tasks or high-risk tasks

Advantages

- Summarises all the steps that are required to ensure successful execution of tasks that are often cross-functional and multi-disciplinary
- Places ownership and responsibility in the hands of the trade section carrying out the work, and ensures ownership of results
- Enhances the safety of upcoming critical or sensitive activities
- Focuses department managers on complex activities

## Flamanville, France

Mission Date; 6-23 Oct., 2014

Maintenance logistical support teams, known as “Wrench time worksites”

The plant uses special outage maintenance logistic support teams to support important maintenance: The teams are based on the idea of a “surgeon being supported by a team of nurses”, and the goal of the technical support team is to improve the “hands-on-tool-time” of maintenance workers.

During outage planning, maintenance activities that are critical or near-critical to completing the outage schedule on time are selected for special support.

Then four months to work execution, the logistics section and the maintenance trades assess the exact needs of these selected work activities in terms of logistical support, special or standard tools, handling equipment, waste management, worksite tooling, RP advice and other logistical considerations.

A dedicated maintenance logistical support team handles all these support activities. On the work execution day, the worksite is ready for use, a satellite store has been set up, handling equipment has been selected, scaffolding is present, waste disposal is organized from start to finish, and ‘runners’ are available to help the operational maintenance team.

For example, the maintenance logistical support teams were used for inspections of train A and B diesel generators, residual heat removal system valves and for primary valves.

Benefits:

- Significant time-saving for operational maintenance teams
- Maintenance teams only need to focus on the technical aspects of their work
- Maintenence activities have more specialized workers.

## Golfech, France

Mission Date; 10-27 Oct., 2016

Portable power-supply box for energizing equipment on worksites (24V/220 V).

The plant has designed a mobile power supply box which is used to transform the 24V power supply provided in the reactor building during outages to 220V.

This compact device is equipped with the necessary cables for connection to a 24V electrical feeder, and converts the voltage to 220V in order to power three outgoing 220V lines.


This device uses 24 Volts to power instruments in the RCA.

Its working principle is to convert a 24V supply into 220V using a transformer. The device comprises a transformer, a 15m power lead equipped with a 24V 'Maréchal' socket and a 220V triple-socket distribution panel. The latter is protected by a short-circuit mechanism and a differential circuit breaker in order to prevent transformer overload.

All these components are built into a sealed and water resistant carrying case for ease of transportation. There is an option for the case to be delivered with a padlock to prevent the instruments from being disconnected during use.

Advantages/Benefits:

The box's design takes account of weight, power capacity and worker safety.

Capacity is limited to 100 VA and is enough to power three MIP-10 or COMO contamination friskers, or any other low-capacity industrial safety instruments. This innovative system provides much more flexibility in the choice of power sources. 220V connections are a rare commodity in the reactor building during an outage, and equipment is sometimes disconnected, or extensions are used for functions other than their primary function. 24V connections, on the other hand, are used rarely or not at all, but they are widely distributed at each level of the reactor building.