The Utility developed and issued to personnel involved in outage activities a pocket sized outage information guide describing the objectives of the outage, health and safety protection of personnel, fire protection principles, foreign material exclusion provisions of the open main coolant systems, and other outage related item related to the expectations of behaviour of personnel. The guide was produced in Czech and English to allow for a wider distribution and understanding of the important information needed to be adhered to during a plant outage. As a result of the issuance of the booklet, issues arising out of co-ordinating activities were being rapidly and frequently communicated by working level contractor personnel to the outage management organisation. This condition prevented waiting for the next daily meeting to be the forum to raise the issue or concern. The team noted that it was unusual in the industry for plants to be using such a communication tool while it is still in a start-up phase of operation.
Civaux has adopted a project-based approach to the management of outages. The organization structure is well defined with team members seconded from various departments to ensure appropriate knowledge and skills are available in the preparation phases of the outage. Integrated information and planning systems are also provided thus enabling the plant to make continued progress in the areas of operational safety, quality, radiation protection, environmental safety and overall outage performance.

Outages are managed by plant senior management, with a high level of support provided by specialist departments. Responsibilities are clearly defined in terms of operational safety, risk prevention, environmental safety and performance.

Outages are coordinated by a multidisciplinary team whose members are assigned from the following areas: maintenance, operations, safety-quality, chemistry, scheduling and industrial safety/radiation protection, as well as nuclear and conventional logistics.

The outage project is divided into a number of modules with effective monitoring, review and follow-up at each stage of the project.

The ten-year project group provides the link between the outage and power operations project teams. It is a cross-functional team in charge of scheduling inspection and maintenance activities. It gives a ten-year strategic vision to site management, support functions and major contract organizations. Hence it provides a clear understanding of:

- Scenarios adopted and outage content for coming years to the outage project team.
- Competencies and skills need to be acquired and developed internal and external to the organization
- Outage strategy and effective transfer into medium and short term planning.
- Workload balanced out for EDF and contract staff.
- Activities to be carried out during power operations to the power operations project team.

Computer tools are used to ensure national and international operating experience feedback is incorporated into the planning process.

A rigorous configuration management tool (SIAT) has been developed on-site to control the change in reactor states during outage periods. This ensures compliance with operations and maintenance requirements during outages and hence safeguards nuclear safety.

Results:
Operational and industrial safety results during outages have been improving constantly since 2000. Excellent results are being achieved in the areas of radiation exposure and the environmental safety.

- Reduced number of significant operating events for which the outage structure is responsible.
- No safety-significant events reported as a result of deficiencies in the planning of activities.
- Reduction in the number of industrial accidents.
- Lowest integrated exposure levels during outage, compared with all other French plants.

Compliance with radioactive effluent production targets.
Outage arrangements ensure safe and effective working. Refreshment booths, toilets and effective use of portable phones in active working area ensure the workers possibility to carry on working safely without exiting the controlled area.

Mochovce, Slovak Rep.  
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.
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.
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.
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 (15 hours/outage)
- Non destructive testing of main coolant piping is no longer affected
- Reduction of the radiation dose
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 feedback.

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 Alaban and across the fleet:
1. Events which occurred in St Alaban 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.
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 Activité Repérente 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 departments managers on complex activities

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 in-time, are selected for special support. Then four months to work execution day, 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
• Support activities have more specialized workers.