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**REPORT**

**OF THE**

**OSART**

**(OPERATIONAL SAFETY REVIEW TEAM)**

**MISSION**

**TO THE**

**SAINT LAURENT**

**NUCLEAR POWER PLANT**

**FRANCE**

**25 November – 14 December 2006**

**AND**

**FOLLOW UP MISSION**

**6-10 October 2008**

**DIVISION OF NUCLEAR INSTALLATION SAFETY**

**DIVISION OF NUCLEAR INSTALLATION SAFETY  
OPERATIONAL SAFETY REVIEW MISSION  
IAEA-NSNI/OSART/08/138F**

## **PREAMBLE**

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of Saint Laurent Nuclear Power Plant, France. It includes recommendations for improvements affecting operational safety for consideration by the responsible French authorities and identifies good practices for consideration by other nuclear power plants. Each recommendation, suggestion, and good practice is identified by a unique number to facilitate communication and tracking.

This report also includes the results of the IAEA's OSART follow-up visit which took place 22 months later. The purpose of the follow-up visit was to determine the status of all proposals for improvement, to comment on the appropriateness of the actions taken and to make judgements on the degree of progress achieved.

Any use of or reference to this report that may be made by the competent French organizations is solely their responsibility.

## **FOREWORD**

**by the**

**Director General**

The IAEA Operational Safety Review Team (OSART) programme assists Member States to enhance safe operation of nuclear power plants. Although good design, manufacture and construction are prerequisites, safety also depends on the ability of operating personnel and their conscientiousness in discharging their responsibilities. Through the OSART programme, the IAEA facilitates the exchange of knowledge and experience between team members who are drawn from different Member States, and plant personnel. It is intended that such advice and assistance should be used to enhance nuclear safety in all countries that operate nuclear power plants.

An OSART mission, carried out only at the request of the relevant Member State, is directed towards a review of items essential to operational safety. The mission can be tailored to the particular needs of a plant. A full scope review would cover nine operational areas: management, organization and administration; training and qualification; operations; maintenance; technical support; operating experience feedback; radiation protection; chemistry; and emergency planning and preparedness. Depending on individual needs, the OSART review can be directed to a few areas of special interest or cover the full range of review topics.

Essential features of the work of the OSART team members and their plant counterparts are the comparison of a plant's operational practices with best international practices and the joint search for ways in which operational safety can be enhanced. The IAEA Safety Series documents, including the Safety Standards and the Basic Safety Standards for Radiation Protection, and the expertise of the OSART team members form the bases for the evaluation. The OSART methods involve not only the examination of documents and the interviewing of staff but also reviewing the quality of performance. It is recognized that different approaches are available to an operating organization for achieving its safety objectives. Proposals for further enhancement of operational safety may reflect good practices observed at other nuclear power plants.

An important aspect of the OSART review is the identification of areas that should be improved and the formulation of corresponding proposals. In developing its view, the OSART team discusses its findings with the operating organization and considers additional comments made by plant counterparts. Implementation of any recommendations or suggestions, after consideration by the operating organization and adaptation to particular conditions, is entirely discretionary.

An OSART mission is not a regulatory inspection to determine compliance with national safety requirements nor is it a substitute for an exhaustive assessment of a plant's overall safety status, a requirement normally placed on the respective power plant or utility by the regulatory body. Each review starts with the expectation that the plant meets the safety requirements of the country concerned. An OSART mission attempts neither to evaluate the overall safety of the plant nor to rank its safety performance against that of other plants reviewed. The review represents a 'snapshot in time'; at any time after the completion of the mission care must be exercised when considering the conclusions drawn since programmes at nuclear power plants are constantly evolving and being enhanced. To infer judgements that were not intended would be a misinterpretation of this report.

The report that follows presents the conclusions of the OSART review, including good practices and proposals for enhanced operational safety, for consideration by the Member State and its competent authorities.

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## INTRODUCTION AND MAIN CONCLUSIONS

### INTRODUCTION

At the request of the Government of France, an IAEA Operational Safety Review Team (OSART) of international experts visited Saint Laurent Nuclear Power Plant (NPP) from 24 November to 14 December 2006.

The Saint Laurent NPP is located on the left bank of the river Loire, between Blois and Orleans. The plant operates two 900 MW pressurized water reactors which were commissioned in 1981. There are two gas cooled reactors at the site which were shut down in 1990 and 1992 and therefore were not part of the OSART review. The plant employs approximately 660 member staff, about 50 additional staff is attached to other EDF entities.

The Saint Laurent OSART mission was the 138<sup>th</sup> in the programme, which began in 1982. The team was composed of experts from United States of America, Slovak Republic, Hungary, Slovenia, Germany, Korea and Finland together with the IAEA staff members and observers from Belgium and Korea. The collective nuclear power experience of the team was 325 years.

The team traveled to Saint Laurent NPP on Friday, 24 November 2006. Saturday and Sunday were spent in team training activities. Following the entrance meeting, which took place on Monday, 27 November; the team conducted the OSART review, completed the initial reports and presented its findings at an exit meeting on Thursday, 14 December.

The purpose of the mission was to review operating practices in the areas of management organization and administration; training and qualification; operations; maintenance; technical support; operating experience; radiation protection; chemistry; and emergency planning and preparedness. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

Before visiting the plant, the team studied information provided by the IAEA and the Saint Laurent plant to familiarize themselves with the plant's main features and operating performance, staff organization and responsibilities, and important programmes and procedures. During the mission, the team reviewed many of the plant's programmes and procedures in depth, examined indicators of the plant's performance, observed work in progress, and held in-depth discussions with plant personnel.

The emphasis for the review was placed on assessing the operational safety performance and effectiveness of management systems rather than simply the content of programmes. The conclusions of the OSART team were based on the plant's performance compared with IAEA Safety Standards and good international practices.

### MAIN CONCLUSIONS

The OSART team concluded that the managers of Saint Laurent NPP are committed to improving the operational safety and reliability of their plant. The team found good areas of performance, including the following:

- A “Fire Committee” including representatives of various plant departments analyses and implements rules and carries out inspections in the field;
- The site of Saint Laurent coordinates radioactive releases from the tanks of the four NPP sites located over a distance of about 200 km along the Loire river when the flow rate of the river is low;
- As part of management aiming to have innovative ideas come up from shop floor level, an innovative idea forum was put in place at the Saint Laurent plant in 2002; this forum involves also contractors and contributes to an EDF wide programme;
- The integration of local and corporate operating experience obtained in a participatory manner with all field staff has enabled the plant to improve outage performance and has led to a positive trend in plant results;
- A laser pointer is used in carrying out radiation and contamination surveys in application of the ALARA principle of optimization of individual radiation exposure;
- Management of radioactive source control was improved by implementation of new software.

A number of areas for improvements in operational safety were offered by the team. The most significant proposals includes the following:

- Senior management expectations, for continuous improvements in the quality of the plant, may not be clearly understood or being implemented at all levels in the organization;
- Operating personnel are not routinely identifying all plant deficiencies in the field;
- The safe and reliable operating conditions for the control room operating personnel are not periodically tested to verify the habitability of the control room in configuration of an emergency with radiological on site impact;
- Some plant equipment are not properly covered by plant (local) maintenance programmes;
- Some maintenance activities are not performed in accordance with industry standards and plant quality expectations;
- Some non-urgent corrective maintenance activities to be performed in one month (priority P2) are not performed within the time limit requested by operations.

Saint Laurent management expressed a determination to address the areas identified for improvement and indicated a willingness to accept a follow up visit in about eighteen months.

## **FOLLOW-UP MAIN CONCLUSIONS**

In summary, St Laurent NPP has achieved convincing and visible improvements since the OSART mission. This has required significant human and financial resources and changes of attitude. Two thirds of the issues have been resolved and the reminder have reached satisfactory progress of implementation. Part of the improvements is a result of an EDF-wide effort which allows the plant to build not just on its own resources but also use the advantage of having joint projects with a series of ‘sister’ plants.



The status of plant responses to the most significant proposals of the OSART mission is the following:

- The plant determined that management presence and involvement in field activities would be the cornerstone of their response to achieve the appropriate high level of plant material condition and housekeeping. Various strategies were adopted such as enhanced operational rigour, management oversight at the right level, sustaining strengths and identifying weaknesses and communicating future planning to the working level. This resulted in the plant being ranked first in the topic of plant and material condition by the EDF corporate-wide review body.
- The operations department has a leading role in the plant-wide programme, which aims to improve the plant's material condition and housekeeping standards. The department is committed to reinforcing the attention of its personnel to details and to creating a sense of ownership and accountability among them. However, several problems of defect identification or management can still be observed in the field, which indicates that there is room for improvement in enforcement of personnel vigilance to comply with the expectations.
- The plant introduced a new test procedure and based on it performed the leak tightness test of the control rooms. The results of the tests proved that the habitability of the control room is not compromised during emergency circumstances.
- It was recognised that the corporate maintenance programme did not cover all the plant at St Laurent. In response six main actions were implemented: the preparation of equipment 'health' reports on the major systems and determination of key equipment, specific differences identified between the corporate and St Laurent specific maintenance programmes, an equipment refurbishment programme was undertaken, a leak management programme was initiated, improvement of the work request prioritisation scheme was undertaken and also enhancement of maintenance quality practices.
- The actions introduced to ensure that plant maintenance staff and contractors complied with quality rules and practices consisted of four main actions which were enhanced oversight of contractors, skills learning and skills renewal of staff, human performance aspects and a leak management initiative.
- In order to ensure that maintenance actions are performed timely, a specific Fix-It-Now team was set up, prioritisation of work requests were readdressed and maintenance windows were set up to allow specific maintenance activities and work packages to take place while the unit was online. Backlogs of activities are monitored by specific indicators and discussed on a weekly basis at the Production Meeting. Since the OSART mission, backlog of activities was significantly reduced. However there is still some way to go to reduce the backlog to a more realistic level.

# 1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

## 1.1. ORGANIZATION AND ADMINISTRATION

At Saint Laurent Nuclear Power Plant (NPP), there exists a clearly defined and well understood organizational structure that is monitored and evaluated on a regular basis. The organization is based on a sound quality management model that incorporates appropriate processes and projects to cover cross-field activities. Through observations and interviews, the team concluded that the organization model works well for strategic planning of routine and non routine tasks. Clear division of responsibilities and authorities between departments was noticeable to the team. This became most evident throughout the review when observing maintenance, operations and technical support activities.

The functions and responsibilities implemented between plant management and EDF corporate management appear to be understood and working well. The management of safety was found to be the highest priority at both the corporate level and at the plant. The team confirmed that the different plant divisions, including contractor personnel, clearly understand their responsibilities sufficient to accomplish their assigned tasks safely and reliably. The team also concluded that personnel position descriptions are well written and that the corporate management of the operating organization provides sufficient resources to the plant. The team was impressed with the high level of corporate support to the plant for managing timely response to plant inquires and priorities. Adequate human and financial resources, along with good technical and administrative services are also made available to the plant during troubleshooting of events and incidents.

The plant uses a well defined industrial strategy to supplement additional contract work. This strategy looks at contractor support needed at the plant, within the region and at the corporate level. The team concluded that this approach works well, is efficient and allows the best use of contractor experience for specialized and safety related work.

Administrative controls are in place to control and monitor staff work activities. Although corporate oversight is well established, there is a clear division of responsibility for decisions on safety related work activities. Saint Laurent, along with several EDF plants is also challenged with the ongoing decommissioning activities of its two gas cooled reactors, scheduled to be completed in 2030. The team concluded that the functions and responsibilities for the oversight and independent monitoring activities at the plant are being done well at both the plant and corporate level.

Safety is considered the highest priority when determining staffing and resource allocation. Saint Laurent has much experience in resource allocation for all routine and outage work. Department managers have developed good strategic plans that are thoroughly discussed and agreed to with senior plant management. The plant manager chairs the most important committees to monitor and provide guidance on a regular basis, ensuring that resources are being used appropriately.

The team reviewed the plant staffing policy and determined that the assigned authorities are appropriate for the work being performed. The team also confirmed that the recruitment and selection of personnel is being implemented to adequately retain a pool of experienced staff to ensure that the plants can be operated safely, under all conditions. Due to retirements,

approximately 30 staff per year for the next three years will have to be replaced. The plant has a good succession plan to accommodate this loss. Temporary replacement for key positions is being done with a safety emphasis to ensure that the long term maintenance of technical and human performance capability remains for each of the assigned areas. In addition, succession planning works on a minimum three year overview with up to a ten year outlook for operations.

The plant manager and deputy plant manager have shared responsibility for external and day to day internal oversight for safely operating the plant. The team concluded that the processes established for policy, strategy and operational activities have focused well on the staffing needs and the maintenance of a highly competent work force. Manager appraisals are well focused to be results oriented and their frequency for review (quarterly) appears to be most effective.

Much attention is paid to ensure human resource management is well established and working well. Forward planning to ensure plant skills are maintained is well coordinated. Professional enhancement programs are done well with good self assessment programs in place.

The team reviewed the fitness for duty policy and procedures and concluded that the internal system of regulating this policy works well and that senior management stays abreast of potential problems, taking appropriate intervention and remedial actions when necessary.

Monitoring and effectively making recommendations to improve the plant operating and support functions is a strength at EDF. Several high layers of safety committees are established to ensure independent and thorough assessment of performance. The interface with the corporate organization is considered good, as it is being implemented in both directions for plant support functions and feedback to the corporate organization.

The plant relations with contractors is being managed very well during outages and unit –in service periods. Contracts are awarded four months before the start of work, which gives ample time for any training and familiarization with the work to be performed. The team was impressed with the amount of involvement of contractors for self assessment activities and their involvement in technical committees and commissions. Contractors can make any suggestions and recommendations regarding plant safety enhancement, and have routinely done so. Contractor surveys are also conducted with neighbouring sites to ensure all available performance criteria are satisfied. The team concluded that the relations between the plant and contractor organizations is healthy, robust and results oriented.

The staff services, that are provided from outside the operating organization, are well understood and being handled most efficiently. At Saint Laurent, a concerted effort to balance experience and expertise is utilized. The plant has a well thought strategy for using regional contractors from the area around the plant, having 4-5 NPP sites to coordinate with. Some specialized work can only be done by certain contractor companies and the remainder that can be done through corporate contracts are well utilized.

At Saint Laurent, there is a clearly defined policy with management oversight for effectively controlling contractors, which ensures that the primary responsibility of the operating organisation rests solely with the plant. Monitoring of contractor performance is being done well with sufficient senior management attention.

The team reviewed the relations with the off-site central and local fire departments and concluded that well established procedures and controls are in place to coordinate responses to accident and fire situations. The equipment made available to the plant and the fire brigades for responding to radiological and biological emergencies was well maintained and sufficient.

The relations with the regulatory and the plant are good. Each discipline at the plant works closely with a regulatory counterpart to ensure that any recommendations or required actions are timely responded to. Constructive meetings between the plant and the regulatory authority are held on a regular basis to ensure good understanding of all commitments. The administrative controls and interface are conducted by the Nuclear Safety Department with an established dedicated group. Periodic inspections are carried out on a pre-determined schedule along with random inspections during outage periods. The team concluded that the process of regulatory oversight and relationship between the plant and the regulator is one of mutual respect and transparency.

The operating organization's commitment to safety is transparent to the public. The plant keeps the public well informed on a timely basis for any hazards or items of interest which may arise from daily operations at the plant. The proper means and tools to disseminate any safety related information to the public are in place and working well.

The team participated in a number of committee meetings and concluded that they were effective and well organized. The team was impressed with the amount of detail, and the depth of discussions conducted during the Nuclear Safety Committee meeting and the Generation Committee meeting. Discussion topics covered industrial safety, nuclear, radiation and environment safety, fire protection, plant availability and site protection. Detailed discussions were not only held on selected topics but self assessment was discussed on the way forward for the next meeting. Open communication and transparency were observed on regulatory actions and commitments. Overall, the team concluded that these meetings are an essential part of management control and contribution to quality and safety at Saint Laurent.

## 1.2. MANAGEMENT ACTIVITIES

Senior management at Saint Laurent has done a very good job communicating goals and objectives to the staff. Due to strategic planning and process management, there appears to be a willingness to introduce new ideas, at least on an annual basis, to meet contract goals. Corporate goals and objectives are the plants first step to defining projects. The most important goals and objectives (STEP 2010 Program) are established within the appropriate departments to support corporate management objectives. Due to management and process reviews, established goals and objectives are realistic set and measurable. There are also a number of internal controls to measure performance (mainly three).

- Audit program
- Site control plan
- Department control plan

External controls are being done on a regular basis by WANO, IAEA, Euratom and the Regulatory Authority.

Recently, there has been a terminology change for management activities at Saint Laurent. The term “medium term strategy” has been changed to “business plan”. This change has encouraged a better estimation of resources, and targets set by EDF corporate are able to be applied systematically to the plant departments resulting in a better projection of where to focus resources on safety related activities at the plant.

The progress toward accomplishment of goals and objectives is reviewed on a regular basis according to the contract model established at the plant. A skills analysis is done when each new contract is signed. Every three months a situation report is sent to the plant manager and a yearly report is forwarded to the department managers. The team also concluded that there is a well developed system being implemented to recognize and appreciate the contribution of individuals and groups towards the accomplishment of plant goals and objectives. The good practice that the team identify on the idea plus challenge and innovative idea for is an excellent example of this effort.

The team conducted a series of interviews with middle managers and determined that their commitment to coaching employees on continuous improvements is well understood. Their presence in the field has resulted in a better understanding of how teams function and the identification of many (over 250 observations) that have been put into a managed database.

Managers indicated that what is needed now is an analysis of the conclusions of these observations in order to further improve the material conditions of the plant and staff work practices. The team concluded that the processes are in place to achieve success in this area and has made a suggestion (1.3(1)) to plant management to accelerate its efforts for continuous communication and reinforcement of its expectations to accomplish this ongoing effort.

The plant has established good processes and projects that are working well, in part due to the strategic committees that focus on a cross-functional approach to solving problems and monitoring activities. Priorities are well identified for tasks involving different departments and contractor support groups. The improvements in 2006 can be attributed to well established management programs that focused on the continuity of good work practices and the improved structure for management presence in the field. The results oriented process approach to work activities has improved coordination among plant departments and increased effectiveness and efficiency for all work, especially safety related activities.

All aspects of the plant programme for safe operation are covered in well developed administrative procedures. The management manuals and job descriptions determine roles, responsibilities and delegations of authority for all managers in key-positions. A well developed system is in place for tracking commitments and corrective actions.

Operating and maintenance procedures are well organized, user friendly and complete. The team concluded that the procedures and their revision process at Saint Laurent are of high quality.

Saint Laurent received ISO certification 14001 version 4 in 2003 and renewed in 2006. A clear policy has been developed to monitor and control liquid discharge and solid waste. The plant has taken the lead for coordinating, with other NPP's, liquid rejects for the region.

Because the plant is located in a world heritage area, much attention is paid to sending the right message to the general public and local authorities about its commitment to protecting the environment. Saint Laurent is proactive in its involvement with regional committees on the environment (eg: NATURA 2000).

The key success of the environmental organization is the networking done with the other NPPs in the region. At the plant, the departments work effectively together with the operations department fully supporting activities to minimize waste discharge.

The department managers conduct routine meetings to review the progress in achieving goals and objectives. Management reviews and process reviews play an essential role in mapping processes and evaluating results. For each review, a program is established to evaluate the last review (strong and weak points) and actions taken. If the actions taken are not quite right, new actions are established. The team concluded that this process is working well to monitor activities within each department.

The management of human performance is well established and is based on a policy for each of the plant processes. The plant has established a number of values for addressing the management principles;

- Judge performance on results
- Empower employees and delegate appropriately
- Managers have ownership and responsibility for results
- Continuous improvement

Senior plant management has determined that an important performance indicator relates to the updated telephone survey, including social relation matters between staff and supervisors.

The strategic vision for improving performance is to be the best in everything. Career advancement is discussed quarterly with all staff. Sanctions are not taken for first time mistakes.

At Saint Laurent a significant number of changes have been introduced in the past year with the launching of the EDF Step 2010 program. The staff in some departments have responded more positively than others to these changes and management is taking necessary steps to encourage positive changes in all departments.

A senior human factors consultant reports directly to the Senior Advisor for Safety and Quality. In addition, when a significant event takes place in the plant, this consultant prepares a separate report in terms of human factors from the plant event report. The human factors liaisons within each of the departments form a team of human factors staff that routinely look at skills of the staff in relation to events and incidents This approach has been expanded to all department business plans. The team concluded that the human factors effort at Saint Laurent is moving forward in line with the EDF STEP 2010 initiative and is highly supported by the senior management of the plant.

Corporate EDF provides good assistance for periodic safety reviews for the fleet of NPPs. Probabilistic Safety Analysis (PSA) is a routine part of all 10 year Periodic Safety Reviews at all EDF NPPs. Corporate level direction is well understood in the Quality and Safety

department and the functional roles for each of the management processes works well to meet plant and EDF goals and objectives.

The plant started a robust program in 2003 for reducing the number of scrams in accordance with EDF directive # 168. The program has three well developed action plans that address units in-service, operations and instrument and controls. Risk assessments are routinely done for specific areas relating to safety and reliability. Human factors have been actively involved in all aspects of risk prevention. The two most identified areas of improvements are the pre job briefings and the one minute delay to assess work activities. The team concluded that the program to identify risks related to scrams works well and encouraged the plant to broaden its scope to address other risks across the plant site as appropriate.

### 1.3. MANAGEMENT OF SAFETY

The team concluded that there is a strong commitment to nuclear safety at Saint Laurent. Managers, supervisors and workers have demonstrated, through their performance, that safety is the highest priority.

At Saint Laurent, a position of Senior Advisor for Safety and Quality has been established. The department head for nuclear safety and human performance specialist report to this position. This organizational function provides independent quality and safety analysis on a daily basis and during any crisis situation. This arrangement works well to independently provide a safety management function at a senior management level at the plant. The Senior Advisor for Safety and Quality chairs the monthly committee meeting for safety and quality. The team concluded that this arrangement provides strong independent oversight for managing quality and safety at the plant on a daily basis.

The management of generation and nuclear safety is well coordinated at the plant and communicated promptly to the network manager. Each morning the shift manager reports the unit's performance and projected 24 hour risk to the network manager. Each limiting condition for operation is analyzed, along with the risk involved and is communicated to the network manager on a regular basis. The goal of the plant is to develop a schedule that motivates the staff in the area of risk prevention and at the same time reduces risks. The weekly generation committee meeting is effective at providing oversight and harmonizing the information for risk prevention

The Nuclear Safety Department (NSD) at Saint Laurent has a very broad amount of responsibility and vast work environment. Safety engineers provide the day to day assessment of the status of nuclear safety at the plants and provide a weekly report which is most helpful for all committee meetings. The tasks are directed by the Guideline # 106 from the corporate office. The NSD provides an independent analysis in all areas affecting nuclear safety. They also provide support and assistance on all safety related matters when requested. The team concluded that the day to day (24 hours/ 7 days a week) operational safety oversight by the safety engineers is excellent for providing an independent view of operational safety management at the plant.

The NSD provides very good support for quality assurance requirements, self assessments and an audit branch for quality contractor oversight. Specific audits are also requested and acted upon in a timely manner. NSD also has a prevention and crisis management group that

maintains quality oversight for fire safety and emergency planning and preparedness. One person in NSD is responsible for maintaining close relations with the nuclear safety authority.

This broad quality oversight responsibility allows NSD to stay current, day to day, on all safety related matters at the plant. The team concluded that quality oversight at Saint Laurent is being conducted robustly, however, has a concern that staffing within this department remains a challenge for the amount of work performed.

There are a sufficient range of indicators in the operating organization to provide a clear picture of its safety performance. Performance indicators are developed and tracked in such a way that they are very useful for senior management to routinely make adjustments, if necessary.

Field tours by NSD quality inspectors are robust and very comprehensive. The schedule and areas for selected review are well planned in advance on an annual basis. The field tours observed by the team proved to be of high quality. However, during one field tour the team observed several deficiencies that went unnoticed by the audit team. Therefore, the team made a suggestion in this area for continuous improvement in the quality of the plant.

Analysis of plant nuclear safety related events are conducted within the framework of DI- 100 corporate directive, which is used by all French NPPs for analyzing significant events. At Saint Laurent, PRO-120 process is used to review significant deviations at the plant. This process is well coordinated between the nuclear safety department and the operations department. Timely notification (48 hours) to the local safety authority. Process PRO-121 describes the flow of activities to ensure that the report of the significant event reaches the nuclear and technical safety working group within two months from the event.

The human factors specialist at the plant gets involved in the review process immediately to assist in determining if human error was a contributing cause to the event. The investigative process is well coordinated with a review of similar events to determine any common causes or trends. Senior management are involved in the process from the very beginning of the review.

The team concluded that the processes used at the plant for reviewing and analyzing significant events are thorough, timely and robust.

## SAFETY CULTURE

During the OSART review the team identified several features of the plant as being characteristic of its safety culture and found a good balance of positive and negative items. It is natural that an organization may have some features that are ahead of others in the process of strengthening safety culture.

These positive features are described below:

- A job rotation policy is applied at different levels of the organization. This facilitates to spread knowledge and experience over the whole team.
- A continuously assessment and self assessment process is followed. This is complemented by external and internal audits.



- A cross functional, multidisciplinary process for risk analysis concerning safety, industrial safety, environment, radiation and availability is applied systematically to plant activities.
- Efficient horizontal communication is established between different departments during the operation (TEF project) and during outage (AT project) of the units to solve emerging problems.
- Several examples of cooperation and partnership between plant and contractors are evident. This cooperation facilitates to ensure that contractors have the same approach as plant staff.
- The plant medical doctor is available 24 hours and has a deep knowledge in handling of RP emergencies. He is also a member of the plant stakeholders committee regarding high risk work planning and contributes to work safety.

At the same time the team found several areas, which could still be improved:

- Compliance with national industrial safety and general technical regulations is a basic prerequisite of rigorous approach to nuclear plant operations. However when compliance is given too much credit, it might decrease awareness to potential risks and opportunities for continuous improvement might be missed.
- Management expectations are not always clearly understood at the worker level. Examples of this can be found in the area of material condition, housekeeping where low standards of acceptance are still present. It will take time until working level staff will be fully on board with management, in respect of being aware and sharing of the plant management's vision for future plant performance.
- Industrial safety risks in some cases are rather analyzed and deemed as tolerable (or compensatory measures introduced) instead of taking all opportunities to eliminate them.
- EDF corporate decisions and regulatory agreement are often regarded as unquestionable conclusions since they represent high level of authority. In several areas the plant relies on the EDF corporate level and external organizations in line with EDF strategy. At the same time it is important to allow more questioning attitude more frequent communication with corporate resources on such topics as design and emergency preparedness.
- During the review in some instances the team did not feel the expected level of receptiveness to review comments and criticism. It might be due to a misbelieve that comments would be considered as a bad review outcome, or the relevant staff being seen as bad performers by the management. In some other occasions safety matters were considered as out of the scope of the particular competence of the staff (business of others in the organization) or the sections of the plant.

#### 1.4. QUALITY ASSURANCE PROGRAMME

The responsibility, authority, structure and organizational independence of the Quality and Safety unit are clearly defined in EDF corporate directive # 106

The quality function at Saint Laurent covers all the activities at the plant, including the services and activities provided by contractors. A good process is utilized to maintain a graded approach in the applications of QA requirements based on the relative importance of the items and safety significance of the activities.

A comprehensive set of QA documentation is available at the plant to describe the overall measures established by the operating organization to achieve management goals and objectives. This is supported by regular committee meetings and adequate senior management oversight.

The French Government set up a policy to control pressure risks in 2003. Saint Laurent has organized an independent inspection department to integrate pressure risk inspections into routine and outage activities. This is being done well to all secondary pressure boundaries and is expected to be extended to nuclear equipment under pressure by 2010. Many audits have been conducted since 2005 with good results. The team concluded that this proactive program is a good performance at Saint Laurent.

The Quality and Safety policy was reviewed and found to be comprehensive and based on the 11 Policies at Saint Laurent NPP, focusing on the top 4 policies. Good brochures (handouts) have been recently developed and distributed. The focus of the QA policy effort is based on measuring improvements through the performance of practices.

#### 1.5. INDUSTRIAL SAFETY PROGRAMME

The team reviewed the programs and processes for risk prevention for the environment at the plant and determined that policies and directives are well understood and being implemented by the staff. Much emphasis is paid to compliance with regulations and follows the same contract based management approach as other programs in the plant. Industrial accidents were a little higher than normal in 2005 due to two outage periods, but 2006 results were good. The plant has been pro-active in taking a prevention approach toward industrial accidents since 2005 and has focused their efforts to prevent fire and tripping hazards. However, the team observed industrial safety concerns in the plant and has made a recommendation in this area.

#### 1.6. DOCUMENT AND RECORDS MANAGEMENT

The GED (Electronic Document Management System) is EDF wide and has been implemented at Saint Laurent since January, 2006. The system is well used to review and control all documents. The GED is linked to all EDF plant sites and is accessible to all staff. The team was impressed with a presentation of the system and the work done by the plant to expand its use at Saint Laurent and has identified this as a good practice.

At Saint Laurent good administrative procedures are established for controlling the issuance, dissemination, review and periodic updating of the records. Records are categorized according to their importance to safety and maintained electronically. Review of records is conducted in a controlled way and the controls are in place for filing and correcting records. Procedures are established to ensure periodic updates are done by each department. The team concluded that records are being managed and controlled properly.

### **SAINT LAURENT NPP FOLLOW-UP SELF ASSESSMENT**

The area in which the plant has essentially improved as a result of the recommendations and suggestions issued during the OSART is that of management and organisation, where the respective recommendations and suggestions (S.1.3 and R.1.5) have been addressed in synergy with those of other areas (S.3.2, R.3.4, R.4.3, S.4.5 and S.4.7 & S.8.5 in part), as part of a managerial project based on presence in the field.

With regard to management inspections in the field, the plant has developed tools and structures to reinforce high standards, exchange views on the perception of reference standards and to assess results. This project is systematically field-driven, where 3200 rooms have been assigned to specific individual owners: thanks to this approach, the entire workforce has been personally involved in improving plant and material condition, for which it has been made accountable.

The results of this initiative, which has been implemented consistently and accompanied by a plant & material condition improvement programme, earned the plant the highest EDF ranking in 2007 for plant and material condition. Corroborated by a zero industrial accident rate, these results have been achieved through the commitment of the entire workforce including both plant and contractors, who all have a clear perception of standards: they also reflect a considerable step forward in terms of nuclear safety.

### **STATUS AT OSART FOLLOW-UP VISIT**

One suggestion and one recommendation were made as a result of the OSART mission in the area of Management, Organisation and Administration. The team found that both issues had been resolved.

The suggestion related to senior management expectations not being understood or implemented at all levels of the organisation. The plant determined that management presence and involvement in field activities would be the cornerstone of their response to achieve the appropriate high level of plant material condition and housekeeping. Various strategies were adopted such as enhanced operational rigour, management oversight at the right level, sustaining strengths and identifying weaknesses and communicating future planning to the working level. This resulted in the plant being ranked first in the topic of plant and material condition by the EDF corporate-wide review body.

An EDF-wide project known as the OEEI, to achieve exemplary plant condition, is being piloted by St Laurent together with several other plants in the EDF fleet. The OEEI team includes management representation.

The recommendation related to the application of a programme for risk prevention and ensuring safe industrial work conditions to all areas of the plant. The plant recognised that clarity of management expectations was required along with the implementation of constant improvement programmes to ensure that the required level of industrial safety is achieved. A site-wide approach was adopted with the commitment and involvement of all staff to ensure that risk reduction initiatives were fully implemented. The plant has been divided up to over 3000 zones and ownership assigned to each and every zone. Every staff member has at least one zone of responsibility whereby corporate plant and condition standards for industrial safety are reviewed for that particular zone on a regular basis. As of 1/10/08, approximately 2600 zones have been assessed by 610 zone owners – this equates to around 95% of all staff and serves as a good indication of staff commitment to the approach. It has been recognised that staff, including contractors, actually become very self-critical when completing the questionnaire and this is seen as a very positive indication of acceptance of this initiative.

## DETAILED MANAGEMENT, ORGANIZATION AND ADMINISTRATION FINDINGS

### 1.2. MANAGEMENT AND ORGANIZATION

#### 1.2(a) **Good practice:** ID+ challenge and innovative idea forum

As part of total quality management aiming to have innovative ideas come up from shop floor level, an innovative idea forum was put in place at the Saint Laurent plant in 2002.

Each EDF and non-EDF staff member working at the plant can suggest improvements in any given area (nuclear and industrial safety, radiation protection, environmental safety, availability, cost, working conditions, communication, organization, etc.). The first level of validation is done at departmental level. It is then submitted for plant-wide validation to the plant innovative idea committee involving all plant departments. An 'idea of the month' is thus selected every month.

At the end of the year, a challenge is organized to pinpoint the best suggestions. During this event, the best Saint Laurent ideas are selected for representation at the corporate DPN challenge.

Savings in all areas (nuclear and industrial safety, radiation protection, environmental safety, availability, cost, working conditions, communication, organization, etc.). Thanks to the current organization, relevant suggestions can be submitted to the corporate DPN innovative challenge, for enhanced performance.

With this system, working conditions can be improved, thanks to the provision of the right solution to a given issue and efforts can be acknowledged (selection of the best idea every month, prizes granted to the winners of the ID+ challenge).

The solutions offered represent gains in all areas.

The suggestions selected during the ID+ challenge are shared with other plants during the corporate DPN innovative challenge. The good practices that are chosen to win are made compulsory to other EDF plants.

### 1.3. MANAGEMENT OF SAFETY

**1.3(1) Issue:** Senior management expectations, for continuous improvements in the quality of the plant, may not be clearly understood or being implemented at all levels in the organization.

The team recognizes that concerted efforts are already underway in this area and the long term efforts, planned by the plant and supported by EDF, take time to implement. However, the team noted several deficiencies that may help focus the plants efforts in this area.

Some of the more important deficiencies observed by the team include:

- Some workers were not fully aware of the priorities for safety and quality set out by senior plant management
- Areas where maintenance work was done, but left in poor overall condition (partial improvements for only work being done to address the specific work order). To further emphasize: The team observed that very good maintenance has been done to ensure the reliability of major equipment, however the opportunity for improving the entire work site for supporting equipment (gauges, electrical connections, labels, etc.) was not always done.
- During a QA electrical room audit in room L-402, OSART reviewer noticed a badly installed breaker cover with the rubber seal twisted all around the opening. The auditor said later he didn't feel qualified to comment on it even if he were to notice it. (auditor program very structured)
- During same audit as above, the team observed 4 of 12 bolts had broken off the back electrical panel of 1 L GA 002TU, Unit 1. No one else noticed.
- Much dust on all relays in relaying rooms of both units in electrical building. The plant is aware, but has been like this for a long time.

Without attention to rigorous detail for continuous improvements in the quality of the plant, on a day to day basis, the material condition and housekeeping of the plant can degrade, over time, below management expectations and IAEA Standards.

**Suggestion:** Consideration should be given by the plant to accelerate its programs for continuous improvements in the quality of the entire plant, and frequently and deeply communicate to the staff its expectations of high standards for material condition and housekeeping.

**IAEA Basis:** NS-G-2.4:

5.5. "In order to maintain high effectiveness of safety management at the plant, the operating organization should ensure a very high level of commitment to safety. The starting point for safety management is the involvement of top managers in all organizational structures. The lead in safety matters should come from the highest levels of management. Their safety policies and attitudes should be of the highest standard, and should permeate the operating organization at every level and extend to

other organizations performing delegated tasks. There can be no complacency at any level about the continuous attention demanded by safety. Safety management should imply a learning attitude to safety matters and the open exchange of information both upwards and downwards within the organization.”

NS-R-2, 6.12. “The plant management shall ensure the effective performance and control of maintenance activities during planned and forced outages.”

IAEA Safety Report Series No. 11: 4.5. Continuous Evolution of Improved Safety Performance.

### **Plant Response/Action:**

The plant has deployed an extensive and varied range of communication initiatives in order to reinforce plant and material condition standards among staff. This has been done frequently and in great detail. In terms of plant and material condition, the plant has used the impetus provided by the OSART review to its advantage and has risen to a leading position in corporate ratings (in 2007, the plant was ranked first by the EDF nuclear inspection department).

The entire programme ranges from the training of specific staff groups to site-wide communication:

- More contractor supervisors were trained (following on from the four sessions in 2006, 6 sessions were arranged in 2007, thus covering the total number of contractor supervisors),
- Plant and material condition is one of the three subjects routinely covered during contractor induction training (training code PP58),
- In line with the industrial safety project,
  - Plant and material condition inspections involving the whole of plant management are conducted on a weekly basis in order to reinforce standards
  - During these inspections, the standard reference procedure is used (109-point checklist used by designated owners of plant areas) in order to assess the standard achieved in the area concerned,
- Within the departments, monitoring plans including a plant & material condition standard have continued to be used, combined with a critical review of craft standards (minor amendments not yet implemented),
- On a daily basis, the housekeeping team (hereafter referred to as the OEEI team) is in direct contact with all relevant staff members. These include field operators and more specifically, senior field operators and new employees, who participate in immersion sessions within the OEEI team. The OEEI team also goes into the field to talk to workers or worksite supervisors,
- On the occasion of its monthly meetings, the OEEI network is used to reinforce expectations in terms of improvement among the various crafts,
- In addition to monthly project reviews conducted by the management committee, specific briefs are delivered during management and supervisor meetings. Various forms of communication are used to convey our objectives to the entire workforce,
- The OEEI team runs a structured defect management programme. This programme has sufficient resources to support its progress,
- The plant has implemented an ambitious plan to work down the number of external leaks.

### **IAEA comments:**

To resolve this issue, the plant determined that management presence and involvement in field activities would be the cornerstone of their response to achieve the appropriate high level of plant material condition and housekeeping. Although the plant had already commenced an initiative in this regard prior to the OSART, the OSART issue served to emphasise and support their initial work. Various strategies have been adopted such as enhanced operational rigour, management oversight at the right level, sustaining strengths and identifying weaknesses and communicating future planning to the working level. This resulted in the plant being ranked first in the topic of plant and material condition by the EDF corporate-wide review body.

An EDF-wide project known as the OEEI, to achieve exemplary plant condition, is being piloted by St Laurent together with several other plants in the EDF fleet. The OEEI teams include management representation and they work very closely with, for example, field operators to achieve optimal housekeeping and material conditions. Feedback from the OEEI team is discussed by management at the weekly Production Committee meeting and resolutions determined with respect to the findings of the team. This ensures that there is continuous improvement in the quality of the plant. A survey of plant staff, held in September 2008, indicated that employees were aware and familiar with the OEEI project and also of the increased management presence in the field.

Several conventional communication methods have also been utilised to get the message across to all staff, that plant condition is vitally important to maintain and improve safety standards e.g. using intranet publications, monthly newsletters and posters.

In addition during September 2008, plant management set aside a day for 170 staff to dedicate to the resolution of outstanding plant material condition deficiencies – approximately 300 defects were closed out as a result of this initiative.

**Conclusion:** Issue resolved

## 1.5. INDUSTRIAL SAFETY PROGRAMME

**1.5(1) Issue:** Implementation and enforcement of the scope and actions for risk prevention, already in place at the plant to ensure good industrial safety work conditions, are not sufficiently applied to other areas of the plant, most importantly, where the team identified deficiencies.

The team observed the following areas needing improvement:

- FYRQUEL leak from valve 1GSS03AR: warning sign posted on elevation +5,50 m of turbine building unit 1, but collection plate does not function well, the toxic liquid drops on heat exchanger (1AHP003RP) and floor on elevation 0,00 m without a warning sign.
- Insulation was cut away, so large hand wheel could be operated. Possibility of getting cut if opening or closing the valve.
- Slipping hazards in Turbine building of Unit 1 (oil and water)
- Tripping hazards of plant (outside) walkway due to concrete removed on yellow painted lines adjacent to walkway. Observed three workers walking on yellow lines.
- Near the heat exchanger (2AHP04RP) of turbine building, scaffolding waiting to be dismantled. Also one leg of scaffold touches a valve which would prevent operation.
- The team noted that a 30 km/hr speed limit is posted at the entrance to the plant and also is aware that a notice has been sent to contractor personnel reminding them of this speed limit. However, the team also observed that no other speed limits are posted on the plant site. During the mission the team observed some vehicles driving at speed exceeding 30 km/hr.
- At the demineralized area (Y 204) if you walk out of the electrical room you cannot see the step by the door and can trip. The expert tripped during the first plant tour.
- During the first plant tour, in the turbine hall, there was a steam leakage from the pre-heater system (known to the plant) but no protection in place. Location, 2 AHP 054VL.

Without adherence to good industrial work conditions in all areas of the plant, workers and equipment may be subject to unnecessary industrial safety risks.

**Recommendation:** The plant should apply the program for risk prevention and safe industrial safety work conditions to all areas of the plant.

**IAEA Basis:** NS G 2.4: Para. 6.56

“An Industrial Safety program should be established and implemented to ensure that all risks to personnel involved in plant activities are kept as low as reasonably achievable”.



### **Plant Response/Action:**

In order to improve industrial safety conditions on all its facilities, the plant has rolled out its risk prevention programme across the whole site. This site-wide coverage relies on a structure that helps to disseminate management expectations in terms of continuous improvement of plant and material condition, so as to ensure that these expectations are properly understood and that they are properly implemented at all levels.

In order to make as many people as possible accountable for risk prevention, all plant areas (industrial and administrative) have been divided up among staff and assigned specific owners. The owners' role is to assess the area and review its level of safety in order to take the corrective actions required.

In order to do this, an assessment form comprising 109 basic questions (answer: compliant/not compliant) has been produced. It provides each owner with a user-friendly reference, making it easier to assimilate the reference standards. This electronic form also provides owners with an evaluation of the area's safety level straight after having input the answers to the basic questions.

The form clearly and concisely states which actions must be taken depending on the type of defect found, while prioritizing corrective actions according to a pre-defined severity scale. The types of response to these defects, which form part of the plant's normal defect management system, are thus communicated to all those workers who were sometimes only partially familiar with them.

All standardized area evaluations are later used to map out the site and categorize the various defects identified.

The quality of these evaluations is assessed by the owner's line management, with input from a risk prevention staff member and a member of the OEEI team. The latter also monitor sensitive areas more closely (e.g. areas potentially liable to generate dose or areas having been poorly evaluated).

The programme's progress is tracked on a weekly basis. It is reviewed on a monthly basis at management committee meetings and is also discussed at health & safety committee meetings.

### **IAEA comments:**

The plant recognised that clarity of management expectations was required along with the implementation of constant improvement programmes to ensure that the required level of industrial safety is achieved. A site-wide approach was adopted with the commitment and involvement of all staff to ensure that risk reduction initiatives were fully implemented.

The plant has been divided up to over 3000 zones and ownership assigned to each and every zone. Every staff member has at least one zone of responsibility whereby corporate plant and condition standards for industrial safety are reviewed for that particular zone on a regular basis. This is done through the completion, following walkdowns by the zone owner, of a simple questionnaire consisting of 110 questions based on the corporate standards for industrial safety. These results are analysed and non-compliances identified, corrective actions produced with prioritisation assigned to the work. Walkdowns are programmed to be undertaken on at least an annual basis.

Commitment to this approach is enhanced by including the workplan into the specific individual's departmental business plan. All staff have access to the zone database which indicates the industrial safety status of the zone according to the latest walkdown survey.

As of 1/10/08, approximately 2600 zones have been assessed by 610 zone owners – this equates to around 95% of all staff and serves as a good indication of staff commitment to the approach. It was noted that one area had not undertaken any assessments to date and it was recognised by the plant that a challenge still exists in that it is still necessary to get all staff to buy into the project.

It has been recognised that staff, including contractors, actually become very self-critical when completing the questionnaire and this is seen as a very positive indication of acceptance of this initiative.

Top Management support for the project should be maintained at its current level to ensure its long-term success. It is worthy to note that a steady decline in the annual lost-time accident rate has been evident over the past two years.

**Conclusion:** Issue resolved

## DOCUMENT AND RECORDS MANAGEMENT

**1.6(a) Good practice:** Electronic Control of Document and Records Management System. Cross-functional project (S.A.R.- SSQ) within the context of an electronic document management project of the fleet and the reorganization of the documentation structure of the plant.

All reference documents are available via the intranet with two access points:

From lists of applicable documents according to entity and process

- By direct search in the document database, according to criteria
- Overview of applicable documents according to entity or process
- Immediate availability for the user and indication of the date of validity and the status of cancelled or out of date documents.
- Various simple search criteria for user
- Possibility to see the last indicator recorded in the centralized documentation department.
- A single documentary reference database at the plant
- Reduce unnecessary documentation (going from 28 to 2) and thus the risk of error linked to its management.
- Availability of documents with the most recent indicator as soon as they are recorded in the centralised documentation with numerous search possibilities.
- Faster availability and improved relations between documentation staff and crafts.
- Simplified access to reference documents due to more frequent consultations of these documents.
- Reduce potential use of outdated documents
- Enhanced control of documentation system by management (Heads of Department and process coordinators) due to lists of applicable documents according to department and process.

All documents can be accessed by the whole fleet and it is possible to access other electronic databases (GED), including the R.P. GED.

## 2. TRAINING AND QUALIFICATIONS

### 2.1. TRAINING POLICY AND ORGANIZATION

The overall training policy of the plant is to ensure that the staff are effectively trained with required skills, are qualified in their craft area, and their skills maintained through effective refresher training. The plant achieves this goal through effective recruitment, vocational training, focused qualification process, and continued skills development.

The plant's training coordination is provided by the Training and Qualifications Department (SFP). The role of SFP is a partnership with the rest of the plant's craft Departments. It is primarily responsible for preparing training for the overall initial and refresher training programs for each department. It provides classroom training on initial theory, general employee training, general safety (nuclear, radiation protection, industrial safety), and initial operator qualification and requalification training. The SFP provides an excellent service by developing and administering a range of training classes as requested by each department based on need. In addition to a range of classroom training support, SFP also provides study areas with references, computer room, fire fighting training area, and a full scope plant referenced simulation facility (simulator).

With respect to policies and programs compared to industry practices, EDF has historically established a medical facility located within the plant controlled area at all plants. The facility is staffed with two doctors and five nurses during normal working hours. During evenings and weekends select medical staff is on call. The ability to have a dedicated medical staff at the plant is excellent with respect to immediate medical response to personnel injuries.

In addition, the medical staff provides routine medical examinations to all plant personnel on a routine basis, annually for many employees. Semiannual medical examinations are required for select personnel responsible for safe operation of the nuclear plant. However, the plant does not have clear documented minimum medical fitness requirements provided to the medical staff to adequately assist them in their assessment of what specific medical and health conditions that the operators' may have that would in themselves contribute or cause operational errors. The plant's current standard for the physical fitness examinations for all plant staff is based on existing general medical guidance.

Industry practice in many countries have established minimum medical requirements for examining physician to evaluate the general health and medical condition of personnel responsible for safety related activities. Examples of general health requirements would include physical condition of strength and dexterity to allow for safe execution of duties, mental and emotional stability, and no medical condition, treatment, or habit which may cause sudden or unexpected incapacitation. Examples of medical conditions that could be considered limiting or disqualifying could include frequent or severe asthma, incapacitating or chronic pulmonary disease, history of heart attack, cardiomyopathy, arterial aneurysm, uncontrolled diabetes, significant anemia, epilepsy, alcoholism, depressive disorder, etc..

Without minimum medical fitness requirements necessary for assisting an examining physician to determine the limiting physical condition and general health of the operators, the operators' limiting physical condition and health could lead to or cause operational errors. The team encourages the plant to consider the establishment of specific criteria on medical fitness requirements for those positions within the plant that are directly responsible for safety related activities.

The plant has an overall vision concerning the improvement in safety culture and human performance. The team observed that the plant has a healthy perspective on safety and continual improvement. In addition, the team noted that the plant management's emphasis and commitment to this vision of continued improvement was noteworthy. The team periodically questioned plant staff to assess the level of their understanding and commitment. After questioning two operators in the control room concerning the current management vision for the plant, only one operator understood that there was such an item. However, the operator was not well versed in what the vision was. In addition, following a nuclear/radiation safety training presentation, seven students were asked about the plant's initiatives (vision). None of them appeared to be truly familiar of such initiative. There may be a lack of emphasis and training with respect to promoting the new vision of the plant. It was understood that there was no specific training focusing on the new vision for the general staff. However, the team was informed that a meeting was held to kick-off the initiatives and that the departmental management is required to disseminate the information to their staff. The team encourages the plant to continue its efforts to provide increased training and staff meetings to further promote and reinforce the plant's new vision to improve overall performance.

There is detailed process for management oversight for operator qualification. The process is controlled by Operations Department and required extensive on-the-job and one-on-one process for qualification. Throughout the individual's qualification it required several management reviews and evaluations before final qualification. Each department also maintained each staff's training records effectively and in a similar manner.

Each organization or department displays good emphasis on assuring effective training to all staff members. The management held responsible for the department training coordination is very committed to appropriately qualify and retrain their employees.

There is good involvement by plant management during training sessions. During a maintenance training session, the first line supervisor for maintenance effectively supported the training by conducting observation, evaluation, and even participation. The supervisor actually played the role of the maintenance supervisor during the training session. In addition, the supervisor also actively participated in the training debrief.

## 2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

The SFP training building, including the plant reference simulator building, is well situated and maintained with ample number of classrooms and training equipment to provide effective training. Each classroom is equipped and is supplied with the necessary training tools including current audio visual aids. In addition, good instructor aids, such as cut away models of the reactor and steam generators, is available. Additionally, the training facility is equipped with adequate space for study areas and student reference material. The training material is well developed and based on identified tasks, objectives and lesson plans.

The department training focuses on shadow and hands-on training in the field; however, each craft department also has designated workshop areas within the plant to provide classroom training and briefing of trainees as needed. Furthermore, the plant has a designated area and program for fire fighting training.

The plant referenced simulator was only installed and placed into service in 2004. Prior to 2004, training for operators were required to be conducted at a central corporate simulator facility. The presence of a plant referenced simulator has extremely improved the quality of operator training. In addition, the versatility of training is realized whereby the SFP appropriately developed training using the simulator for maintenance, and emergency preparedness.

The full scope simulator is appropriately being maintained. The instructor booth is situated to allow for good observation of operator performance. The simulator is appropriately equipped with computer controls for recording plant conditions and equipped with video and audio system to record operator performance. This tool is used for debriefs with operators.

The simulator is maintained with respect to configuration control compared to that of the actual plant. The plant adequately maintains a report which annotates differences between the plant and simulator. Many of the differences are associated with indications, range of indications, different units, and different types of instruments (meters vs. recorders). These differences can create potential confusion during training and evaluations, and could potentially pose situations of negative training. However, the plant has adequately maintained a listing of such differences and has a process of informing the operators of the differences. Furthermore, the plant has a process whereby the simulator instructors maintains a log which tracks newly identified problems on the simulator. These problems can range from simple maintenance issues to potential differences. The items are logged, tracked, and amply resolved. In addition, the plant has noted that during the 2006 plant outage several modifications were installed in the plant. These modifications are being reviewed and planned for implementation on the simulator during the scheduled 2007 simulator maintenance outage.

### 2.3. QUALITY OF THE TRAINING PROGRAMMES

All departmental training programs and records are well maintained using similar methods within the specific departments by a training representative and owned by the Department manager. Individual staff's training files include the yearly plan, completed training, specific job classifications, list of qualifications, and the annual training plan review that was discussed and agreed upon by both the employee and his manager.

The plant implements a corporate wide four step process for ensuring and maintaining the overall needs of individual knowledge and skills. As part of this process, on an annual basis department management interviews staff personnel to assess staff progress and address future needs with respect to training. Specifically, at this plant in 2004, a preparation guide was included in this interview process which provides detailed guidance for both management and staff for their preparation for the annual performance assessment and training needs interview. This was considered as a good practice.

The four step process also includes a computer program, a skills map, that analyzes the current status of personnel with respect to their projected departure from the plant and their level of competency then it projects a comparison of both the future needs and the projected losses of specific competencies. This program appears to be useful and informative in assisting plant management to focus on the training needs in the future to assure that sufficient skills and knowledge are sufficiently met. This program was developed by the Maintenance Department in 2003, and similar programs are being used by all plants within EDF, this was an indication of continued good performance.

The SFP provides excellent support and is a service oriented organization and does not have overriding authority. The actual responsibility for ensuring both initial qualification and retraining proficiency is placed on each respective Department Manager. In fact, even if there is a failure during an evaluation of a training course, the failure information is relayed to the Department Manager to decide on a course of action. Although SFP provides feedback and recommendations which are taken into account by the departments, its responsibility appears to be hampered for the final treatment of a failure is up to the department manager. The team encourages the plant to consider the possibility of granting the SFP training organization the responsibility to remediate trainees with poor performance with respect to the administration of their training course prior to returning the trainees to their respective departments. That is, if a student fails a course, the training department may evaluate the weaknesses, may focus retraining on the weaknesses, and may reevaluate the student before releasing the student back to his department.

The plant has a good awareness and plans to periodically provide refresher training on technical qualifications and general plant requirements. However, the main safety refresher training (nuclear, radiation, and industrial safety), has a 3 year cycle. The plant is working to reassess the periodicity of such training and looks to reduce the time period between refresher courses.

#### 2.4 TRAINING PROGRAMMES FOR CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

The SFP conducts initial training for control room operators based on requirements set forth by corporate. The training program last approximately 15 months which includes theory, simulator normal operations, abnormal operations, and emergency/accident operations. At the end of the SFP training the individual is not yet qualified. The individual must also participate in shadow training in the control room conducted by Operations Department. On an average, the shadow training in the control room may take up to 6 months. During this period of shadow training, the individual is not yet qualified until he/she fully completes all the requirements for qualification. The initial classroom and simulator training are conducted in parallel with the shadow training.

Once the operators have achieved initial qualification they are required to systematically attend refresher training. The refresher or requalification training for control room operators are conducted on a 2 year training cycle. During the 2 years, the operators are rotated on 7 week cycle to conduct both classroom and simulator training. During this period, the minimum number of days spent on simulator training, required by corporate level, is 20 days (10 days per year and per operator at 7 hours per day). The plant has set itself a goal of 30 days per operator during this two year cycle (15 days per year and per operator). This yearly goal has been met since 2005. This target of 15 days per year and per operator appears to be adequate to allow sufficient time spent on the simulator for refresher training. The overall operator training program including initial and refresher training is based on systematic analyses of job requirements and is well organized and effectively implemented.

During observation of a biennial operator qualification evaluation on the simulator, concerns with respect to maintaining examination security were noted. While the evaluation was occurring, an unauthorized individual entered the simulator room. This was noted and dealt with by the SFP manager. A sign is posted on the simulator door, but it could be more visible so as to be a more appropriate warning.

The simulator has a panoramic interior observation window whereby any individual can observe the activities in the simulator during either training or examination. The plant does have blinds on this window; however, they were not closed during the evaluation. In addition, the plant has a formal procedure but it does not cover all aspects of examination security. The team encourages the plant to consider adding to its existing simulator operating procedure the missing elements of security for evaluation activities, including simulator room security and evaluation material security.

The team observed a training scenario and biennial operator refresher simulator evaluations. The plant administered one simulator scenario to an operating crew of three operators for their biennial qualification evaluation. The evaluations were conducted satisfactorily. The overall evaluation was conducted systematically focusing on evaluating only 2 operators at a time with one instructor for each evaluated operator. This meant that the instructors at the same time were responsible for operating the simulator, adjusting audio visual equipment, taking and making phone calls to the crew acting as representative plant personnel, and evaluating and documenting their evaluations. This practice may potentially over task some instructors.

## 2.5. TRAINING PROGRAMMES FOR FIELD OPERATORS

Field operator training was reviewed from task analysis through final program development. Individual training file, is maintained for each employee and contains training completed and planned and includes safety and technical authorization certificates. The Operations Department Manager ensures the programs and services are provided as necessary to the field operators. The field operations training was found to be generally effective in meeting the operations department needs.

## 2.6. TRAINING PROGRAMMES FOR MAINTENANCE PERSONNEL

Maintenance training is similarly organized and maintained as with other departments. Initial qualification and refresher training were also monitored and maintained in the same manner within the maintenance and I&C departments. Retraining on maintenance personnel, ranging from 2 to 3 years, was focused as a priority on selected safety significant topics. Training material and use of mock ups was good, including mock ups for steam generator and inverters.

Due to a significant amount of work being accomplished by contractors, the maintenance department has focused their attention to closely monitor contractors. As with other departments at the plant, there is an overall policy to have an assigned individual who monitors and evaluates effectiveness and implementation of contracts requirements. Audits are performed on the contracted company and feedback from the plant and department determines their continued work. The plant has developed a role playing training program to support and train EDF contractor supervisors. This training initiative was field-based which included situational scenarios. The programme is still maturing with additional training of supervisors monitoring contractors for 2007. The team considered this a good performance.

The plant initiative to use the simulator for maintenance training was very good. Both the operating crew and maintenance personnel were tasked to perform risk assessment based on a failed safety related reactor instrument role playing. The team considered this a good practice.



## 2.7. TRAINING PROGRAMMES FOR TECHNICAL PLANT SUPPORT PERSONNEL

Safety engineer training is based on competencies and skills and coordinated in the same manner as the other departments. It is effective and provides the necessary skills development to ensure that safety engineering oversight is a useful service to the plant. The team noted that the safety engineers conducted refresher training with a mix of safety engineers from two other sites, Chinon and Dampierre. Although this practice is conducted at other EDF sites it was noted as a good performance which promoted exchange of ideas and lessons learned.

Other technical programs such as Radiation Protection, Nuclear Engineering and Chemistry are developed with the same task and skills base. Objectives are determined and training provided, monitored and assigned within policy and procedural commitments. These programs appear to be in line with the improvement action plan that has been developed and coordinated with human resources.

## 2.8. TRAINING PROGRAMMES FOR MANAGEMENT AND SUPERVISORY PERSONNEL

The management and supervisory personnel training program is effective and has a broad range of topics. The program focuses on general management skills, such as leadership, communications, project management and coaching. This management training uses a combination of tools to enhance management selection and development including 1<sup>st</sup> line management network, panel evaluation grid for 1<sup>st</sup> line management, and professional enhancement plan for shift supervisors.

In addition, the program also focuses on the required training and re-training of managers with respect to technical competency and understanding of emergency preparedness plan including the management of severe accidents (GIAG) beyond normal emergency procedures. With respect to GIAG training, the team identified that although senior management in 2004 may have taken an introductory training on their responsibilities during GIAG but refresher training is not required for senior management. The team has made a suggestion concerning the establishment of refresher training on GIAG activities for those senior management members involved in the GIAG procedures.

The operations competencies for shift supervisor and deputy shift supervisor are, for example, focusing on management skills and strong review panels that challenge the candidate as they progress through the organization. They provide a method that is part of a structured selection process. This review and training also focuses on identifying the appropriate attitude and safety perspective of the candidate. All management positions are reviewed against established expectations for the potential candidate and are based on assessed competencies.

## 2.9. TRAINING PROGRAMMES FOR TRAINING GROUP PERSONNEL

The SFP training instructors are well trained and experienced in the processes of instructor skills. The instructors have good technical and plant knowledge, whereby, many of the instructors were recruited from the plant with many years of experience as operators themselves. During observation of a safety training, the instructor demonstrated excellent knowledge of the subject, his instructor skills was very good, and he utilized very good instructor and student aids.

## 2.10. GENERAL EMPLOYEE TRAINING

General employee training is developed based on tasks and is of good quality and systematically provided as a refresher routinely every two years. The initial training and refresher courses are appropriately structured and in accordance with plant policies and standards. All staff participates in the training and the training includes quality assurance, radiation protection, fire fighting, industrial safety and regulations and guidelines.

### **SAINT LAURENT NPP FOLLOW-UP SELF ASSESSMENT**

The recommendation on providing senior management with refresher training on severe accident management has been implemented in liaison with the EPP engineer and the training department. Implementation of this recommendation intrinsically constitutes progress in terms of nuclear safety and does not require further comment.

### **STATUS AT OSART FOLLOW-UP VISIT**

One suggestion was made by the OSART team with respect to the training and qualifications area and this related to the plant establishing refresher training for senior management involved in the emergency planning organisation with severe accident management responsibilities. Refresher training for the senior management team was undertaken in May 2008 and eleven members of the senior management team underwent training. The objective was to re-familiarise the team with the state-based emergency procedures and then their transition to severe accident management guidelines (GIAG). The undertaking of the training is now a procedural pre-requisite for holding positions within the Emergency Planning organisation of the site. The issue was found to be resolved.

## DETAILED TRAINING AND QUALIFICATION FINDINGS

### 2.3. QUALITY OF THE TRAINING PROGRAMMES

**2.3(a) Good practice:** The plant in 2004, developed a preparation guide which was included as a requirement for the annual interview process. This guide provided detailed guidance for both management and staff for their preparation for the annual performance assessment and training needs interview.

The plant as with all the EDF plants must perform an annual review of the needs and performance of each staff. This process is delineated in the Technical Note 4835, which has been in place similarly for other plants for approximately 10 years. However, in 2004, the plant worked with the unions to get their support in providing improvement into this process which ultimately benefited both the staff and management. With this in mind, the plant developed a guidance for both staff and management on specific items to prepare for the annual interviews. This makes the process more efficient and more consistent from one interview to another.

Therefore, the plant developed a key guide for both staff and management with specific topics for each to prepare for their interviews. This guide was added to the existing technical note and notable improvement in quality and efficiency, and consistency was evident. Discussion with two departments and couple of technicians indicated satisfaction and noted that the interviews were more worthwhile.

The guide titled, “The Individual Interview is a Privileged Moment for the Exchange and Dialogue Between the Employee and the Management,” listed two guidance information for the employee and the manager. For each member the guide listed three topical areas with detailed bullets of expectations.

The employee was required to be prepared for the following: (1) to exchange with his supervisor on the activities he has been given, (2) to know his objectives, and (3) to prepare his expectations. For item (1), the employee must be prepared to explain his difficulties, express his satisfaction in his job, propose improvements, and have feedback on his activities. For item (2), the employee must be ready to participate at the definition of his objectives, and know what is expected from him. For item (3), the employee shares how he develops his experience, expresses his improvement wishes, and lets his supervisor know his training needs.

The manager was required to be prepared for the following: (1) to appreciate the individuals contribution, (2) to explain and share the objectives and decisions, and (3) prepare the evaluation of his team. For item (1), the manager must recognize and develop the successes, identify the competencies, and appreciate the results. For item (2), the manager must explain the missions and demands of the plant and to define the objectives and the actions for the year to come. For item (3), the manager must measure the abilities of the employee, dispatch the missions and objectives according to everyone’s wishes and abilities, and define the training needs according to the missions and objectives of the plant’s needs.

## 2.6. TRAINING PROGRAMMES FOR MAINTENANCE PERSONNEL

**2.6(a) Good practice:** Training department's use of simulator for maintenance support training using role playing scenarios with operations crew. Which includes multiple debriefs following simulator role playing for a maintenance training session. In addition, the role playing use by the plant was well used in other areas, including emergency preparedness training whereby improved communications between different emergency planning organizations within the plant was realized. For example, the training on communications and use of the 3D-3P emergency equipment during emergency preparedness and severe accident situations.

The maintenance role playing training was specifically set to focus on human performance requirements with respect to instrument testing/maintenance of safety related equipment affecting the response of the simulator (plant), risk assessment and staff response. The training focused on pre-briefs by maintenance personnel given to the control room operators, participation by all involved in analyzing risk, the execution of the activity and subsequent mitigating actions due to given problems during the scenario. Following the training session debriefs were effectively conducted. In fact, not just one but three debrief sessions were conducted. One was a combined debrief with both maintenance and operators. Then there were two additional debriefs conducted separately for maintenance and operators only. Each debrief was well structured with good participation and satisfactory facilitation by the instructors. The team has noted the presence of the first line management during the training and debriefs. The presence of human factor engineer was also noted, who participated actively to debrief on the human performance topics. This training effectively demonstrated the use of the full scope simulator to improve the interaction and support between operations and maintenance.

## 2.8. TRAINING PROGRAMMES FOR MANAGEMENT AND SUPERVISORY PERSONNEL

**2.8(1) Issue:** The plant has not established a requirement to have all responsible senior management members involved in the management of severe accidents to take refresher training.

The organization that operates a nuclear power plant has the responsibility for safe and efficient operation of the plant. Inherent in this overall function is the responsibility of senior managers to understand plant conditions and actions necessary to authorize plant staff in their performance of mitigating the consequences of severe accidents. This includes training on the concepts, procedures, and facilities directly relating to severe accident management.

The plant had established new procedures with mitigation of severe accidents (GIAG) in late 2004. Subsequently, the plant established training and re-training procedures for GIAG activities including procedure Code CCAG, “GIAG Operationnel Population Equipe Locale de Crise,” or severe accident procedure for operations crew and local emergency team, and procedure Code 9608 19RC, “Recyclage APE/GIAG Pour ELC/PCL,” or severe accident refresher training for emergency team and emergency control centre. These procedures were established in 2004 and 2005, respectively. However, both procedures did not require senior management, PCD1/2, to take the training. Procedure Code A688, “Environnement Chefs de PCD,” or environment for senior management noted two items on GIAG, and it was listed as required for all senior management. At the end of 2004, operations team, safety engineers emergency command post (PCL) and emergency team (ELC) members underwent initial GIAG training (CCAG and CIAG). Specific refresher training for PCL and ELC members (9608 19RC) was also set up and implemented from September 2005.

Senior management within the emergency preparedness organization, designation of at least PCD1/2, are responsible for the overall authority and decision making with respect to severe accident mitigation and management.

Staff carrying out the duties of PCD1 and PCD2 also followed initial CCAG training between November 2004 and January 2005. Initial A688 training has systematically been delivered to those who have arrived at the plant since January 2005. Its main aim is to train participants in the use of the GIAG related decision making document and to measure the consequences of decisions that are taken. Nonetheless, since the initial training modules, PCD1s and PCD2s have not received refresher training.

Without assuring that all responsible senior management are properly trained and adequately retrained, as necessary, on emergency preparedness and mitigation/management of severe accidents could lead to mismanagement of activities during accidents.

**Suggestion:** The plant should consider establishing requirement to administer refresher training to senior plant management that are required to authorize and make decisions (PCD1 and PCD2) with respect to severe accident management.

**IAEA Basis:**NS-G-2.8: par. 4.40.

“Plant managers and senior operating personnel should be trained in directing plant staff, using available information, plant systems, and equipment to mitigate the consequences of severe accidents. Operating personnel should be trained in recognizing situations in which the EOPs are not adequate and accident management procedures and/or guidance should be used. Training exercises should be designed adequately to ensure that the decision making function is developed and clearly understood by the accident management team.”

**Plant Response/Action:**

The plant has rolled out a compulsory refresher training programme for staff members occupying a senior management position within the emergency planning organization. This programme has been up and running since May 2008, with refresher training being provided every 2 years.

Training is provided by the plant training entity. Training objectives focus on:

- A review of concepts and principles associated with state-based emergency operating conditions
- Deducing plant conditions from the strategies and procedures being applied
- Principles associated with the drawing up and use of severe accident management guidelines (SAMG), as well as the criteria for applying them
- Description of physical phenomena encountered during severe accidents, with associated risks
- Identifying changes in strategy and organisational arrangements when switching between state-based operating conditions and severe accident conditions

In terms of approach to training, the idea is to seek a balance between the points reviewed during classroom sessions and an active portion based on one or two situational training sessions using concrete scenarios. The small number of trainees per session (4 to 6) is more conducive to their involvement in situational training.

At the end of the initial trial sessions, trainees corroborated the usefulness of the programme in terms of training objectives and methodology.

Skills acquired from this training are put into practice during corporate EPP drills.

**IAEA comments:**

Refresher training for the senior management team was undertaken in May 2008. It was held over a period of a full day and eleven members of the senior management team underwent training. Two groups, of various emergency plan organisational status (PCD 0, 1 and 2) received refresher training on two separate days. The objective was to re-familiarise the team with the state-based emergency procedures and then their transition to severe accident management guidelines (GIAG). The SIPACT simulator on site was utilised to simulate severe accidents and allowed the team to appreciate the consequences of their decisions taken during the scenarios.

The undertaking of the training is now a procedural pre-requisite for holding positions within the Emergency Planning organisation of the site.

Currently, the refresher training is undertaken on an annual basis and it is being considered that this can now be extended to be once every two years.

**Conclusion:** Issue resolved

### 3. OPERATIONS

#### 3.1. ORGANIZATION AND FUNCTIONS

The Operations Department of Saint Laurent NPP is responsible for the operation of two 900 MWe units. The organizational structure of the department is simple and at the same time provides an opportunity for the department manager to effectively control the operational activities via delegation of duties and responsibilities and establishment of support structures. Documentation and training support groups are established in order to minimize the administrative tasks for the shift crew.

The plant management has established and clearly communicated the management expectations and standards for the department in the form of department management contract. The management expectations and standards are communicated to the operators via the shift managers contract. The expectations and standards, that are represented in goals and objectives, are measurable and manageable in number.

Performance indicators are established and routinely tracked on the different level of management meetings to improve performance. The results are clearly communicated to the operations group and posted in operational work places.

There is a formal routine established for the managers in the operations department to ensure that they carry out regular in-plant tours. Interviews with the in-plant staff revealed that senior management tours did not happen very frequently during the normal work hours, but mostly on weekends when they were on call. It would appear that the senior management does not have enough time scheduled during normal working hours to effectively conduct plant tours.

The operational organization is set up to optimise interface between maintenance and operations, and creating a partnership between departments. The plant has implemented an on-line unit management in project mode. The project has its own objectives, which are validated by all heads of department represented on the platform. The project head regularly meets the managers of these departments. The plant senior management is involved and supports the shift and project managers. As a result of introducing the project, improvements have been reached in the number of scheduled activities performed and the management of urgent and unplanned events. The team considers the establishment and implementation of the “Unit in power operation” (TEF) project as a good performance.

The plant has introduced a well managed and organized outage management system. To enhance the management and performance of work during outages, a permanent unit outage off-shift structure has been established. This structure was included into the operational flowchart of the plant. During the outage the off- shift outage structure and the on-shift team are strengthened to improve performance on planning and safety. The outage off-shift structure provides continuity of information within shift team throughout the day. The team considers this to be a good performance.

In accordance with the requirements defined by the corporate level, the operations department employs adequately qualified and licensed personnel for each operational shift position. The department’s training support group is effectively planning, coordinating and documenting the refresher training activities and skills management process for the shift personnel.

Inside the department’s organizational structure a skills working group (GT) was set up at the end of 2004 in order to have an exchange on the meaning, the objectives, the resources and the tools for skills management. The GT seeks to incorporate all the main issues and requirements in terms of skills management. The GT is made up of deputy shift managers (1



per shift), human resources deputy department manager, and the departments training advisor. It enables the deputy shift manager to take a leading role in skills management within the shift operations team. Quarterly meetings ensure that the progress of the department's action plan can be measured in relation to skills management, to have regular exchanges with the deputy shift managers on requirements and good practice, to decide on appropriate and innovative actions to maintain and develop the skills of the operations staff. The team considers the establishment of the GT to be a good performance.

There is a seven shift rotation within the operating organization which provides adequate rest periods and necessary training opportunities for all shift personnel. The staffing levels of each team are adequate and guarantee minimum staffing requirement which is defined for the most limiting accident condition.

There is an efficient system for timely support to the plant's on-shift crew. In particular, senior manager and maintenance craft personnel are always on-call. Their duty is to support the shift manager in case of unexpected deviations. In case of a safety significant event, the shift manager's duty is to make a quick evaluation of the event and prepare a notification for the regulatory body.

### 3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

The Units' Main Control Rooms (MCRs) are identical and located in a close vicinity to each other separated by a common unit space. This common area is used to hold briefings and debriefs. It is equipped with an instrument panel common to both units, as well as, common alarms and fire detection panels.

The MCRs are well organized and allow the operators to receive prompt and sufficient information of equipment and systems status. In some reactor instrumentation panels in the computer room some indication lights have been replaced by LEDs. With the existing light covers it is difficult to identify whether the lights are on or off. The team encourage the plant to change the light covers to allow the reliable identification of status of instrumentation. Procedures and equipment for normal and emergency activities are accessible to the operating crew. The procedures are adequately used by operators. Adequate space is provided to ensure good conditions for operators. Documents are managed and updated by off-shift operations staff generally in accordance with the quality assurance rules.

The control room operators are supported by a computerized information system providing all the needed plant parameters. The established policy for MCR annunciators is "dark board" which the plant has made efforts to achieve. The control room lighting, layout and furniture adequately support the operators.

Every unit has a fully operable Emergency Shutdown Panel (ESP) from where the safe shutdown can be performed in case when the MCR needs to be abandoned. All necessary operational procedures, manuals and other operational aids are available in the MCR and the ESP. The plant has implemented technical measures to ensure that both MCR and ESP habitability is maintained during emergency conditions. However there is room for improvement for the habitability of the MCRs in emergency conditions and the team recommendation is reflected in the EPP part of this report.

The communications between the control room staff and field operators are conducted through wireless phones, announcement system on loud speakers or by pagers. In addition the same system is used by the rest of operations personnel. The access to the MCRs by other plant personnel is limited administratively.

The control room is equipped with all the necessary telephones which provide direct connection with fire brigades, emergency centres, and grid dispatching centres.

As a lesson learned from several events, in order to improve industrial safety, the plant introduced a new sign posting system for the industrial buildings approximately 2 years ago. It helps plant personnel to properly orient themselves in the industrial buildings. For example it has improved the process for staff evacuation in confined room with any hazards, and has put up signs displaying personnel protective equipment should be worn before entering a given area. Thanks to the signposting, staff members are aware of conditions for access into an industrial building or room. This system was implemented by other French plants in the previous years. The team considers this system as a good performance.

Although a lot of effort was spent recently by the plant to properly label plant equipment, discrepancies in the labelling practice still exists. The plant launched a thorough labelling review a year ago. Since the beginning of that review about 2500 labelling problems were corrected by using formally approved temporarily paper labels. From this amount of labelling deficiencies, the plant has succeeded to eliminate approximately 700 paper labels through November 2006 by using permanent labelling.

Nevertheless several different components were found during the OSART plant tours and field observations with no labels or illegible labels, hand written labels other than those authorized by the plant, or labels corrected manually. This is also the case for safety related valves. The team made a suggestion for improvement in this area.

A procedure for posting information in the field was issued in November 2006. This procedure required at a minimum the following information on these postings: date, responsible person and organization to keep the posting up-to-date, purpose of posting, and the date when it should be removed. However, due to the fact that this procedure was only recently issued, uncontrolled warning instructions, hand written schematics, operating instructions and supplementary information were identified on the panels and walls of the control rooms and in different plant areas. A formalized and documented Operator information system exists for the control room personnel. The procedure on controlling operator aids is not fully implemented. The team made a suggestion for improvement in this area.

The plant overall cleanliness is adequate, although in the turbine buildings there is still room for improvement in this area. The team encourages the plant to continue the necessary efforts for assuring that the turbine building cleanliness will go along with the international industry good standards.

### 3.3. OPERATING RULES AND PROCEDURES

The operating rules for the plant are defined by Operating Limits and Conditions (OLC) which is one of the General Operating Rules chapters. Operations procedures are developed based on the OLC limits. The surveillance test program is well planned and executed using surveillance test procedures. Surveillance test data is inputted to an electronic database so that important plant parameters are available site-wide for review and analysis. Conditions that impact on OLC are clearly defined, documented and tracked by the shift personnel at all levels. A white board is used in each control room to indicate such conditions.

The whole set of operating procedures and the alarm response sheets are available for the control room operators. During the observations the team noted that the operators used the procedures properly. When they were interviewed, they exhibited a “procedure using

attitude”, a very good orientation in various procedures, as well as skills in how and when to use certain procedure.

Operating procedures are generally in good condition, clearly written, well understood and provided the necessary references. The team noted that the process for temporary procedure modifications is formalized and based on the use of deficiency reporting sheets.

Although procedures to cover actions to be taken during all operating states of the plant are developed and set up within the working places, the team observed that in some cases the procedures are not corrected or updated in a proper manner. Untraceable, unverified handwritten mark-ups appear in the body of the procedure, without the approval. The team noted as well that there is no systematic periodic review of operational procedures and the process for updating operational documents is not implemented systematically.

The team suggested that the plant should enhance the system for reviewing and updating operational documentation and to assure that properly updated and valid documentation is used at all working places.

Symptom based emergency operating procedures are developed for each operational mode and implemented to cover design basis accidents and beyond design basis accident up to severe accidents. Symptom based emergency operating procedures are easily accessible. They are kept in transparent sealed plastic pockets, stored in glassed shelf protected with plastic seals to prevent unauthorized use.

### 3.4. CONDUCT OF OPERATIONS

The team observed main control room operators’ behaviour and their attitude. The operators presented professional approach when performing some actions in control room and appropriate response to alarms was demonstrated as well.

The activities related to the shift turnover and the shift turnover itself were observed by the team. There is a debriefing before the end of the shift and briefing after the start of the shift, where all completed shift activities and those planned for the coming shift are summarized and supplementary information by shift crew is shared. All information provided by the team members is taken into account. Everyone participates in the debriefing and individual input is valued. These briefings are headed by operations deputy shift manager (CED). They are organized in the common room located between the two control rooms. The shift turnover is performed separately for each shift position, between the debriefing and briefing the whole shift crew.

The team noted that the shift debriefing process is a very effective tool to convey information for all the shift personnel and considered it as a good performance.

The team considers that the turnover process is efficient, however, the CED turnover efficiency could be increased by reducing the noise (mainly coming from the corridor next to the CED office, that is used as the members of the new shift crew arrives) and mainly by sitting the two CEDs next to each other (instead sitting face to face) so that both of them were able to read the documents.

The safety engineer and the shift manager systematically conduct a daily review of the status of the safety significant equipment and any off normal events and perform mutual crosschecking. Key control system effectively supports system reliability.

The team observed that several workers have the generic authorization to enter the electrical building, from which there is no other physical barrier to control access the control room than

a sliding door. The sliding doors to the control room are motor-operated, and there is a possibility to block them from the control room. When to block this door is not prescribed in a procedure, the operators make a decision based on current activities in the main control room.

There is a red line on the floor inside a control room. Based on administrative procedure, every person entering has to stop and ask operator for entrance permission. This verbal permission is valid as long as the workers purpose is justified.

There are also warning lights at ground level of the building and near the control room indicating if access to control room is limited or forbidden. The team observed that control room operators do not always use this device (e.g. it was used for Unit 1, but not for Unit 2 during the common shift turnover).

Although there is an administrative procedure to control access to main control room, in several countries the access to control room is more restricted and it is treated more strictly.

Surveillance test program of the plant equipment is well organized. Scheduling for performance of test execution is based on a computer database, as a part of SYGMA software.

There is a project (PHPM) for surveillance test harmonization among the same type of EDF NPPs. The set of procedures has been created and has been submitted to the regulator for final approval. The implementation is expected for September 2007.

The plant has established systems which utilize administrative, operational and maintenance lockout methods for preventing plant equipments against unauthorized maneuvering. The requirements are to chain and lock the equipment with a padlock and post a tag. If there is no possibility to chain or secure the equipment, despite of efforts made by the plant, the plant requirement is just to put a padlock and a tag on it. The necessity to physically secure equipment was not required by the plant because personnel were not allowed to maneuver equipment with posted tag. During the plant tour and other observations the team noticed that the plant personnel were not systematically using the locks, chains and tags in order to secure equipment against unauthorized maneuvers. The team suggested improvement in this area.

The plant introduced a deficiency tagging system for identifying leakage type deficiencies of the equipments and installations in 2005. The plant extended this system for the safety equipments in 2006. The operational department has recently started a program which deals with improving the deficiency identification skills of the field operators. Some improvement can be seen in this area. However the identification of equipment deficiencies, other defects and housekeeping problems on the field was still inadequate compared to international standards. The team recommended improvement in this area.

Field operators check the equipment during periodic walk down. They record certain parameters using a portable electronic device to transmit them into a computerized database. Parameters are recorded once a day, to focus field operators' observations during other walk-downs on more housekeeping and general overview.

Every shift crew checks equipment visually, to record defects. In spite of the fact that checklist for walk down is available, its use during observation is voluntary based in accordance with plant rules. After the walk down, the checklist is printed out, filled in based on the notes made on the field, validated by the control room operator and then stored. When the field operator considers that a defect need to be fixed, work request is raised. The leakage type and safety related equipment defects are labelled/tagged on the field. Other defects that field operators consider as more related to housekeeping are recorded in an electronic

database for the “reactive” team, which is in charge to give priority of the entries related to housekeeping.

For unit start up after refuelling and maintenance shutdowns, the adequate procedures are developed and are ready to use in the main control room. The team observed, that the operators are familiar with procedures and they are capable of using them.

After a scram a special procedure is used to confirm an appropriate response of the equipment to the event and for proper unit restart.

### 3.5. WORK AUTHORIZATIONS

Work authorization procedures clearly define responsibilities and authorities.

For the work request preparation, a computer application is used for work permit issuing. Based on methodology, a risk assessment is performed in advance both of the planned or unplanned works. The conditions for work are detailed in the work permit request.

In the operations department a tagging office is established. The tagging officers are senior control room operators. They are in charge of the tagging process to validate appropriate conditions to perform maintenance and they issue the work permit. Tagging officers prepare the equipment in accordance with the work permit, usually at night before the maintenance.

The control room operators are notified before tagging operation is performed.

In the control room the tags provided by tagging office are used to mark switches related to unavailable equipment. If the equipment must be qualified after maintenance, a test is performed with maintenance people present.

The team observed a line up of the vacuum pump after its maintenance. A tagging officer lined up the pump in accordance with procedure and notified control room operators. A field operator checked the pump visually. The pump was started up from the main control room. Maintenance staff and tagging officer were not present at this time at the pump location. Furthermore, the field operator was not aware of the purpose of the maintenance work. The team considers that the tagging activities, preparing for maintenance, performance of maintenance work, tag removal and start up of equipment are satisfactory from an administrative point of view. However, the quality of the maintenance job close out including cleanliness was not systematically checked on the field. The team encourages the plant to improve the tag removal process, system line up and start up after maintenance. An independent check on-the-field of equipment and workplace after maintenance may also improve housekeeping and material conditions.

Temporary modification procedure is effectively implemented by the plant. Risk analyses has to be performed for each modification. The installation of the modification is approved by the shift manager. All the temporarily modifications are controlled and tracked in a proper way.

### 3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

The plant has implemented fire protection program, based on systematic fire prevention approach.

Plant management is aware of the importance of fire risk and delegates responsibility and appropriate enforcement power to competent staff to deal with fire protection programme.

The importance of the fire protection at the NPP is supported by several examples:

- Existence of a so-called “Commission incendie” (fire committee) in which all departments are represented. This committee carries out a minimum of 2 walk-down per month and keeps track of all problems notified.
- All deviations due to negligence are reported to plant senior management, that takes appropriate measures.
- Fire officer systematically analyses all events which are put into database SAPHIR (EDF fleet event database system) and other international operational experience feedback related to fire risk received from CID (EDF corporate department that examines and spreads international experiences).
- Report is issued weekly, indicators are established and published monthly.
- Complete replacement of the fire detection system, initiated in 2005 to raise its reliability, will be achieved this year.

The team considers the existence of the fire committee and its activities to enhance fire protection as a good practice.

Portable fire fighting equipment is well maintained, and places with extinguishers are well labelled. Nevertheless, mainly in the administrative building, some portable extinguishers are put into movable pedestal without any sign on the wall.

The team observed that in some cases the signs indicating location of fire protection devices are not properly visible.

The fire extinguishers are maintained on a regular basis; there is a visible sticker on the extinguishers showing the date of the last inspections.

At the outside of buildings, fire extinguishers are located in a box, to preserve them. The box with fire extinguisher N° 419 was found to be impossible to open (handle blocked in position). There is a plan to change the box in 2007.

Maintenance on fire barriers appear adequate. No evidence of problems was found during inspections in the electrical building. Nevertheless, the team observed three damaged fire stops on cable tray 9N2003A in building BAN and also one on the tray above OG1403A in the cable corridor in the liquid effluent treatment building between SEK/KER. These were results from a modification in which new cables were added in those trays.

The team observed a good surveillance test program, including specific walk-down by fire committee two times per month, systematic and documented verification of fire barriers prior to restart after outage and middle cycle.

The team observed that a comprehensive evaluation has been carried out for the management of fire load, as well as for their installations as for their periodic controls.

Permanent and temporary storages are checked independently by their owner, by the department in charge of security and by the fire committee.

The fire response team is composed of shift member is available at all times. This team is well trained in specialized independent organization on regular basis, in which the fire fighting training both initial and refresher are administered with real conditions. On site fire response team is very well equipped, a special car with fire response equipment is available. Also the fire fighting training for all plant staff is performed regularly.

During one fire fighting exercise, the team observed high level of performance of fire response team and very good coordination among other participating teams such as an external fire brigade and first aid team. For better orientation for external fire brigade, there

are 10 muster points created on site. Flashing lights indicates the best way from the site entrance to this muster point. A plastic ribbon is rolled out from this muster point to the fire location.

The fire officer heads systematic debriefing evaluation of the exercise. Members of external fire brigade are also present during debriefing. The team observed that there was no independent observer for the exercise in the control room (functions assured by the shift manager, that also carried out actions in the frame of the exercise). The team encourage the plant to increase the efficiency of the exercise and debriefing by considering the possibility to have an independent observer in the control room.

### 3.7. MANAGEMENT OF ACCIDENT CONDITIONS

The minimum shift composition of 14 staff is required per pair of units, there are two operators present all the time in each control room.

This composition has been established based on a penalizing design accident (fire in an electrical room causing loss of external electrical sources, diesel engine stand-by and injured personnel).

An on-call system is established to assume availability of a team of competent people at all time for support.

Severe accident procedure (GIAG) exist, clear roles and responsibilities of the personnel taking actions are set.

GIAGs are accessible for control room operators. Full set of procedures is stored in a locked cabinet in the room next to control room. The keys are in shift manager office and in glassed-in box pointed up on the wall next to cabinet.

State based operating procedures and GIAGs are developed for every work position separately. Different colour pictograms are used for certain working position in procedure to help prevent human errors.

The boundary between the symptom based operational procedures and GIAGs is defined based on parameters which indicate significant core degradation. The sensors used for measuring these parameters are qualified for severe accident environment conditions.

### **SAINT LAURENT NPP FOLLOW-UP SELF ASSESSMENT**

The recommendation and four suggestions in the area of operations, combined with the managerial project mentioned in the MOA paragraph, have helped the plant to make significant progress in embedding standards within operations staff, as well as in improving their professional rigour.

Indeed, field operations staff have improved their detection abilities and raised their standards with regard to housekeeping: this improvement has been clearly noticeable during the weekly management housekeeping tours, in which a field operator routinely takes part.

In concrete terms and in addition to the fundamental actions plans involving them (lockouts, line-ups), field operators – spurred on by the group of senior field operators – have assumed responsibility for affixing more than 2000 labels produced on the site, while continuing to install lockout devices on the plant.

Extensive efforts regarding document control have simultaneously been made with a view to keeping tighter control over operator aids and updating the document base.

Significant improvements in labelling, lockouts, field operator detection skills, and tighter control over operating documents, as well as the response to encouragements regarding fire-drill debriefs and continued efforts to improve turbine hall condition have brought about clear improvements in terms of nuclear safety.

### **STATUS AT OSART FOLLOW-UP VISIT**

The plant has, according to the suggestion of the OSART team, speeded up the process of eliminating the labeling deficiencies of plant installation. The follow-up mission confirmed that the activities relating to the management of labeling deficiencies are adequate and ongoing according to the expectations.

The plant has put emphasis to ensure that the management of the operational documentation complies with the QA requirements. The OSART follow up team confirmed the compliance of the operational procedures with the relevant standards and expectations.

The operations department has conducted a systematic revision of all physical protection against unauthorized manoeuvre on the field and introduced modifications where considered it was necessary. During the plant tours the OSART follow up team confirmed the adequacy of the lockout practice at the plant.

The plant has revised its administrative document and included in it quality assurance requirements concerning to posting of operator aids in the field. Furthermore the plant has made efforts to ensure that their personnel comply with the rules described in the procedure. However, during the plant tours the OSART follow-up team observed some unauthorized and incorrect operator aids in the field. The team noted that the plant should make further efforts to enhance full compliance with the expectations.

The operations department has a leading role in the plant-wide program, which aims to improve the plant's material condition and housekeeping standards. The department is committed to reinforcing the attention of its personnel to details and to creating a sense of ownership and accountability among them. Observations during the follow-up mission tours and the available data confirmed that the adopted approach corresponds to the suggestion offered by the OSART mission. However during the field tours several problems of defect identification or management were revealed which indicates that there is room for improvement in enforcement of the personnel vigilance to comply with the expectations.



## DETAILED OPERATIONS FINDINGS

### 3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

**3.2(1) Issue:** Labelling does not sufficiently support plant operational personnel to properly identify plant installed components.

Although a lot of efforts were spent recently by the plant to properly label the technological systems and components, discrepancies in the labelling practice still exists. The plant launched a thorough labelling review a year ago. Since the beginning of that review there have been identified about 2500 labelling problems corrected by using formally approved temporarily paper labels. From this amount of labelling deficiencies the plant has succeeded to eliminate approximately 700 until November 2006 by using permanent labelling.

Nevertheless, several different components were found during the OSART plant tour and field observations with no labels, illegible labels, hand written labels, other than those authorized by the plant, or labels corrected manually. Some examples are indicated below:

- No labelling on valve 1 RPE 384 VP important to safety (BK building, room K013)
- Not all valves are labelled in cabinet 1 KRG 209 CQ (BK building, room K014)
- Hand written modification on labelling of electrical cabinet 1 KRG 121 BN (Unit 1 electrical building, room L620)
- Label on box 2 KRG 101 CQ is damaged (Unit 2 pumping station)
- Illegible label on the level sensor 1 RCV 107 LN (BAN building, room NA 217)
- Double and contradictory labelling for fire penetration (BK building, room K 117)

Incorrect labelling can lead to operational errors.

**Suggestion:** Consideration should be given to reinforce and speed up the process which the plant has already started in order to eliminate labelling deficiencies of plant installations.

**IAEA Basis:** 50/SG/Q13 342:

“Plant areas and installed items shall be uniquely and permanently labelled to provide plant personnel with sufficient information to positively identify them.”

DS347, par. 5.2. “The labelling standards used should ensure that the labels are suitable for the environmental conditions in the place where they are to be mounted and that the equipment is identified without potential errors. The format and placement of labels should allow the operators to identify the component quickly and easily and should prevent easy or inadvertent removal or misplacement of the labels.”

#### **Plant Response/Action:**

Actions taken by the plant in response to this suggestion have focused on two main aspects.

The first follows on from actions taken prior to the OSART review held in 2006, regarding the updating of plant labels. Shift operations staff affixed more than 2700 labels over the period spanning mid-2007 to mid -2008. Labels were affixed by the OEEI team during the outages held in 2008, particularly in the reactor buildings.

The second seeks to sustain the labelling standards achieved to date.

Firstly, labelling is one of the items reviewed by room/area owners during their industrial safety inspections (see area evaluation forms). All staff members have thus been made aware of the importance of labelling standards. On the occasion of unannounced field inspections, area evaluations for industrial safety purposes, or management field inspections, whenever someone observes a labelling defect, they affix a temporary paper tag. The permanent label is subsequently affixed by a member of the on-shift operations crew responsible for the plant system with defective labelling, or by a member of the OEEI team. This system is set up to detect new labelling defects on an ongoing basis. Operations staff members have been made particularly aware of the importance of labelling, firstly through their involvement in the affixing of new labels, but also through constant reminders issued by senior field operators, leaders of the plant and material condition programme within their respective teams.

Equipment identification and more specifically labelling are also inspected by contractor supervisors when maintenance jobs are commenced and closed out (see worksite commencement/close-out reports used by maintenance). These inspections provide an opportunity for identifying any labels that might have been damaged during maintenance. The operations and maintenance department managers (mechanical maintenance/I&C), as well as the head of the joint modifications structure, have set up a joint initiative to reinforce this aspect of contractor oversight.

Prior to the 2008 outage cycle, contractors were briefed on the importance of labelling and on the need to keep labels in sound condition.

Lastly, the plant has acquired an engraving machine. This tool has made it possible to rectify labelling defects more promptly, efficiently and flexibly.

**IAEA comments :**

The plant has, according to the suggestion of the OSART team, speeded up the process of eliminating the labeling deficiencies of plant installation. The plant has corrected approximately 4800 labels during the last two years. The number of incorrect labels waiting for amendment is relatively low (200).

The operations department put special emphases on managing label deficiencies. The operational personnel are well trained on the labeling standards, the weekly management inspections, the close collaboration with the plant's OEEI team. All these characteristics guarantee that the plant will sustain the standards achieved to date.

The plant tours conducted during the follow-up mission confirmed that the activities relating to the management of labeling deficiencies are ongoing according to the expectations.

**Conclusion:** Issue resolved

**3.2(2) Issue:** The procedure on controlling operator aids is not fully implemented.

A procedure for posting information in the field was issued in November 2006. This procedure requires indicating, as minimum, the following information on these postings: date, responsible person and organization to keep the posting up-to-date, purpose of posting and date when it should be removed.

However, probably due the fact that this procedure was only recently issued, uncontrolled warning instructions, hand written schematics, operating instructions and supplementary information etc. were identified on the panels and walls of the control rooms and different plant areas. Currently a formalized and documented Operator Information system exists for the Unit control room personnel.

Examples of the uncontrolled aids are listed below:

- A4 size sheet with picture taken from the nuclear island drain and sump system panels including different line-up sequence indications were posted on the wall (Unit 1,2 control room)
- Next to 0SEK switch a “Desinhibiter 9 KRT 901 MA AVANT TOUT REJET KER OU TER” orange sticker is posted (Unit 9, panel PC)
- Below the switches DVN 007, 008 ZV white sticker is posted with “ATTENTION ARRET DVN07+DVN08 ZV PERTE DE LA TOTALITE DVN” (Unit 9, panel PC)
- Uncontrolled hand painted values can be found on 1 GRE 020 SP pressure measurement gauge (Unit 1 Turbine Hall, room M528)
- Hand written uncontrolled white sticker is posted on the panel 1LLE indicating the desired adjustment of thermal protection of the device 1 DSI 104 AR (Unit 1, Electrical building, room L406)
- Hand written additions are found to system diagram on the panel 1 PTR 001 AR (Unit 1, BK building, room K216)
- Uncontrolled operator aid on panel 01D2 near 2TEP 004 ID pressure indicator (BAN building, CR)
- Uncontrolled operating instruction displayed on the panel 2 LHQ 002 AR (Unit 2, Diesel control panel, room D241)
- Uncontrolled hand written instructions on shutdown panel train A (Unit 2)

Uncontrolled and incorrect operator aids can lead to erroneous operator activities.

**Suggestion:** Consideration should be given by all effected plant personnel to enforcing full compliance with the instruction on how to control effectively operator aids.

**IAEA Basis:** DS 347 par. 6.16, 6.17.

6.16. “An administrative control system should be established at the nuclear power plant to provide instructions on how to administer and control an effective aids programme and should include the following:

- Types of operator aids that may exist in the plant;
- The authority who is competent to review and approve operator aids before they are used;
- Assurance that operator aids contain the latest valid information.”

6.17. “The operator aids control system should prevent the use of unauthorized operator aids and other supportive materials.”

### **Plant Response/Action:**

Unauthorized operator aids, i.e. posted information that does not comply with QA rules, have been included as an item in the area evaluation forms used for industrial safety inspections. This aspect is therefore dealt with in the same way as fire-fighting equipment operability or equipment leaks.

Senior field operators have been briefed in greater detail on the shortfalls of posted information that has not have adequate quality assurance. Senior field operators have been tasked with cascading this message down to their colleagues on shift. Shift teams have carried out periodic inspections of information posted on the plant.

In order to manage information posted on the plant, it has been decided that any new posted information or the removal of existing information suggested by a member of operations staff must be reviewed and approved by all senior field operators. The engraving machine is also used to print technical information (see valve position on feedwater pump turbine lubrication and control fluid system). This machine provides a prompt resolution for ensuring that operator aids are quality-assured, provided that their presence is approved by the senior field operators.

In addition to these measures, the operations department has updated its document control system so as to be able to process operator aids in the same way as standard operating documents (see procedure 0406 "Document control within the operations department", 5160-SD-PRO-0406). Operator aids will eventually be incorporated into a referenced document (generally an operating procedure), providing it with all the quality assurance required. The operator aid is updated by a member of the department's document control team (SHQ DOC) when its parent document is revised. Operator aid locations are specified in the respective document distribution list. Operator aids are managed by means of the operations document-control database GESDOC.

Procedure 0337 "Operator aid management (form and content)" (D5160-SD-PRO-0337) and technical memorandum 5517 "Form and content of operator aids" (D5160-SD-NT-08/5517) have been updated in order to provide an exact description of operator aids for which the operations department is responsible.

**IAEA comments:**

The plant has revised its administrative document concerning posting of operator aids in the field. The revision aimed to introduce the same quality assurance requirements in the procedure which are used for the other operational documentation.

The operations department has made efforts to ensure that their personnel comply with the rules described in the procedure. The operations department has reduced the total number of unauthorized operation aids in the field. However, during the plant tours the OSART follow-up team observed some unauthorized and incorrect operator aids in the field. Two of them were already documented in the OSART mission report in 2006 and listed below:

- Below the switches DVN 007, 008 ZV white sticker is posted with “ATTENTION ARRET DVN07+DVN08 ZV PERTE DE LA TOTALITE DVN” (Unit 9, panel PC)
- Uncontrolled hand written instructions on shutdown panel train A (Unit 2)

The plant should make further efforts to enforce full compliance with the expectations.

**Conclusion:** Satisfactory progress to date

### 3.3. OPERATING RULES AND PROCEDURES

**3.3(1) Issue:** There is no systematic periodic review of operational procedures and the process for updating operational documents is not implemented systematically.

- Electrical Building, room L405 (Emergency Shut Down Panel), one of the emergency procedures has no control stamp
- Unit 2, Turbine Hall, procedure posted on the wall No. D5160-SD-PRO-0313 has no control stamp
- BK, fuel building, 1EAS154VR, drain tube plugged in 2002 is not reflected in the operational procedure nor as a temporary modification
- Unit 1, alarm response sheet JPI002AA has handwritten correction without signature, the administrative updating process has not been initiated
- handwritten correction in operational instruction SLHP1 – SLHQ1 in control room, the administrative updating process has not been initiated
- periodic review of operational procedures is not required

Without reviewed and properly updated operational documentation, on the working places, correct action may be skipped or inappropriate action may be taken.

**Suggestion:** The plant should consider enhancing the system for reviewing and updating operational documentation to assure that properly updated and valid documentation is used at all working places.

**IAEA Basis:** NS-G-2.4

6.75. “Documentation should be controlled in a consistent, compatible manner throughout the plant and the operating organization. This includes the preparation, change, review, approval, release and distribution of documentation. Lists and procedures for these functions should be prepared and controlled.”

DS 347 para. 4.22 “The procedures, drawings and any other documentation used by the operational staff in the main control room or anywhere in the plant should be approved and authorized according to the specified procedures. These documents should be regularly reviewed, updated if necessary and controlled, and should be in good condition.”

**Plant Response/Action:**

In order to take advantage of the standardized EDF fleet, all surveillance tests falling within the scope of General Operating Rules have been standardized. Each of these standardized surveillance tests is managed by a site that is tasked with producing its initial version, rectifying reported deficiencies and performing periodic revisions.

As far as non-standardized operating documents are concerned, the periodicity for revising documents used by the operations department (operating instructions, surveillance test procedures, alarm response sheets) has been jointly defined with the safety/quality department. Periodicities are shown on the documents. In accordance with procedure 0035 "Document Review" (D5160-SD-PRO-0035), the plant's documentation centre provides the operations department's document section with the

list of documents having reached their expiry date. This section reviews the documents to establish whether or not a revision is required.

56 alarm response sheets and 90 system procedures have been revised since mid-2007.

Operating documents undergo periodic checks. As an example, all documents for unit-1 and unit-2 main control rooms were checked page by page in 2007 and 2008. Checks and action items are recorded in the operations department's GESDOC database. Further to these checks, 75 action items (from GESDOC) were issued in 2006 and 90 in 2007, the increase from 2006 to 2007 being due to application of the new 5-yearly review periodicity.

The list of amended operating documents used by operations staff is inserted into the electronic shift log, for the shift crew's attention.

Procedure 0406 "Document control within the operations department " (D5160-SD-PRO-0406) has been revised in order to include new measures for managing operator aids, document review periodicity, use of GESDOC, rules for handwritten changes to standardized or non-standardized documents, tracking of document checks and ensuing actions, and the rectification of document deficiencies.

**IAEA comments:**

After EDF benchmarking the plant has defined the periodicity of their operational documentation, which is 5 years. This requirement was then incorporated into the revised administrative procedure. The plant has reviewed 1300 non-standardized procedure from which 56 alarm response sheets and 90 system procedures have been revised.

Along with the EDF strategy the plant will extend the volume of the standardized procedures which undergo revision in the future.

The plant has put emphasis on ensuring ensure that the management of the operational documentation comply with the QA requirements. During the plant tours the OSART FU team checked the compliance of the operational procedures with the relevant standards and expectations.

**Conclusion:** Issue resolved

### 3.4. CONDUCT OF OPERATIONS

#### 3.4(1) **Issue:** Plant equipment is not sufficiently secured against unauthorized maneuvers.

The plant has established systems which utilize administrative, operational and maintenance lockout methods for preventing plant equipments against unauthorized maneuvers. The requirements are to chain and lock the equipment with a padlock and post a tag. If there is no possibility to chain or secure the equipment otherwise the plant requirement is just put a padlock and a tag on it. The necessity to physically secure equipment was not required by the plant because personnel were not allowed to maneuver equipment with a posted tag. During the plant tour and other observations the OSART team noticed that the plant personnel did not systematically use the locks, chains and tags in order to secure equipment against unauthorized maneuvers. Some examples noted by the team are listed below:

- Valve 1 RIS 415 VP locked open the chain and padlock does not prohibit to turn valve on few rotation (BK building, -10,5 m)
- On the valve 0 SDX 123 VR chain was not installed to prevent maneuvering the valve, only a padlock (Unit 2 water makeup building, room Y103)
- Hand valve 1 STR 034 VL should have been locked but was not locked with chain jammed in between the valve stem and the casing of the valve. (Unit 1 turbine building)
- Valves 2 SIR 039 VR and 2 SIR 040 VR have been secured by chain and padlock but can be operated.

Inadequately secured plant equipment can adversely affect the safety of the plant and the personnel in case of unauthorized maneuver.

**Suggestion:** Consideration should be given by the plant to reinforcing methods which ensure that the related equipment is adequately protected against unauthorized maneuver.

**IAEA Basis:** DS 347 par. 4.12

“During the shift specific measures should be maintained to prevent unauthorized access to systems and equipment important for safety.”

DS 347 par. 7.21 “Suitable arrangements should be made for locking, tagging or otherwise securing isolation points to ensure safety.”

#### **Plant Response/Action:**

This suggestion was reviewed by the operations department task force (“equipment isolation taskforce”), one of its duties being to find ways of improving physical protection of components.

The efforts of this task force produced the following main results:

- New systems for physically locking quarter-turn air valves (59 valves affected) and nuclear island fire-protection cylinders have been developed and are being implemented on the plant;



- A new method for physically locking 380V electrical breakers has been implemented;
- Efforts are underway to upgrade locking systems, with the purchase of new locking devices (1000 beige plastic rings, 100 locking devices for 200V breakers, 22 plastic boxes for preventing valves from being operated);
- A lockout inspection plan has been draw up.

The task force's efforts have also produced results in the field, where 680 valves have been fitted with lockout chains.

Equipment lockout requirements have been set out in a document entitled "Lock-out fundamentals". Senior field operators have been briefed on these requirements so that they can cascade them down to the field operators in their respective teams. Field inspections conducted by operations staff, including department housekeeping tours conducted every Thursday morning, also provide an opportunity for reinforcing these standards. The participation of operations staff in site housekeeping inspections on Friday mornings is an effective means of raising the awareness of other departments and of conveying expectations regarding equipment lockouts.

In order to raise the awareness of the entire workforce, the "lockout" item is also included in the room evaluation sheets (see points 1.3 and 1.5). This helps to increase the likelihood of detecting lockout deficiencies.

Lastly, following the difficulties experienced during the 2008 outage cycle with regard to position-assured component lockouts, the operations department has decided to implement a specific plan to address this issue.

**IAEA comments:**

The operational department has conducted a systematic revision of all physical protection against unauthorized manoeuvre in the field. Based on the conclusions of these revisions they defined where it is necessary to introduce new types of locking devices.

After purchasing from the market or self-manufacturing of these devices they equipped the new devices or replaced the old ones which did not provide sufficient protection against unauthorized manoeuvring.

In order to assure the sustainability of this improvement the operations department briefed all the operations personnel about the requirements and issued a document called « Lock-out fundamentals ». Also the representatives of the operation personnel take part in the different plant level site inspections, which focus, among others on the lockout practise.

During their plant tours the OSART FU team members confirmed the adequacy of the lockout practise of the plant.

**Conclusion:** Issue resolved

**3.4(2) Issue:** Operating personnel are not routinely identifying all plant deficiencies in the field.

The plant introduced a deficiency tagging system for identifying leakage type deficiencies of the equipments and installations in 2005. The plant extended this system for the safety equipments in 2006. The operational department has recently started a program which deals with improving the deficiency identification skills of the field operators. Some improvement can be seen in this area. However the identification of equipment deficiencies, other defects and housekeeping problems on the field is still inadequate compared to international standards. Some examples are introduced below:

- Oil leak and excessive corrosion on 2 AHP 022 VL and 2 AHP 004 VL can be found (Unit 2, Turbine building)
- Deposit of sulphuric acid exists at the flange of sulphuric acid piping (demineralization plant)
- Several areas of oil leaks underneath and around 2 LHP and 2LH Q diesel groups area can be found (Unit 2, diesel generator rooms)
- White phosphate around 2 RRI pump shaft can be found (Unit 2, room 238)
- Cable tray supports above 2 ARE 317 VL and 2 ARE 341 VL are broken (Unit 2, turbine hall, 0,0 m)
- Heavy hoses left hanging on valve 2 SEH 104 VH (Unit 2, Turbine hall)
- Wires leading to sensors on the pipe close to 2 RRT 005 LT were not properly isolated (BAN building, room NF 263)
- Rubbish (dust, metal part, wire, broken drill, borer) on the floor next to the door of Q204 room (BAN building, room 216)
- Metal debris and spare parts were found hidden behind the support structure of pressure gauge 1GRE020SP. (Unit 1 turbine building 16m, room M528)
- Garbage can be found on a the cable tray above the shutdown panel door (Unit 2, electrical building, room L448)
- Dustbin has been found in front of a box containing breathing apparatus (Unit 9, electrical building, 11,5 m)
- Remote control device with cable of a crane improperly spooled up round an electrical box located on the wall (Unit 1, BK building, room K216)

Untimely identified or improperly managed equipment and housekeeping deficiencies can lead to damage or inoperability of the equipment.

**Recommendation:** Plant should establish a comprehensive system for timely identifying and properly managing of the equipment and housekeeping deficiencies found on the field.

**IAEA Basis:** GS-G-3.1: par. 6.59

“Any individual, who finds products or processes that do not meet specified requirements, or who observes abnormal behaviour, should be obliged to report the matter formally using the appropriate process.”

DS 347 par. 4.33 “Operator rounds should be responsible for verifying that operating and standby equipment operates within normal parameters. Operators should take note of degrading equipment and environmental conditions such as water and oil leaks”.

DS 347 par. 5.49 “All deviations in the plant, system or equipment status should be reported and evaluated properly and in a timely manner and a system for documenting such deviations should be clearly established including an evaluation of the impact on operability.”

**Plant Response/Action:**

Senior field operators are the leaders in matters of field operations for their respective teams. Senior field operators hold periodic meetings that are led by a shift manager or a member of the operations senior management team. Senior field operators have been specifically designated to address the OSART recommendation.

The OEEI team has trained all senior field operators on plant & material condition reference standards drawn up by the EDF nuclear inspection department ("Guideline for assessing plant and material condition on nuclear power plants ", referenced D4008.26.97.047 GU rev. 5). Joint field inspections have been performed by senior field operators and the OEEI team in order to put these guidelines into practice. These reference standards were reviewed at one of the senior field operator taskforce meetings. Senior field operators then cascaded these standards down to the field operators in their respective teams.

Senior field operators produced three field inspection guides in 2008. Focusing on general expectations for field operators in the operations department, the guide sets out expectations on how address deficiencies, while also describing housekeeping standards.

All operations staff members have put a great deal of effort into the industrial safety evaluation programme (see 1.5). By the end of 2008, more than 800 rooms will have been evaluated by operations staff. The operations department has been performing weekly plant & material condition inspections since mid-2007, outside of outage periods. Participants include one field operator, one deputy shift manager and one member of department senior management. This provides an opportunity to exchange views on plant & material condition standards and ensure that these standards have been properly assimilated by field operators. In addition, one field operator systematically takes part in the plant’s Friday-morning housekeeping inspections (see 1.3).

A representative of department senior management has met with each team to discuss housekeeping issues in order to highlight their implications and assess the efficiency of our defect management system. Housekeeping/plant & material condition is a regular item on the agenda of department senior management meetings.

These actions raise staff awareness of expectations regarding this issue, by clarifying their necessity. The number of findings raised by operations staff increased significantly in 2008 compared with previous years: more than 660 findings were raised by operations staff during the first five months of 2008, exceeding the number raised in 2007 by more than 100.

The plant has set up a fix-it-now team (EDIR) that is able to promptly address deficiencies raised by shift teams. By mid-2008, approx. 350 work requests had been addressed by the EDIR team since October 2007. This responsiveness encourages shift teams to report defects detected in the field.

A defect found on the plant is identified by a specific tag. The OEEI team assigns the defect to the relevant department, which is responsible for rectifying it. By physically identifying defects in the field by means of a tag, defect management is made easier by preventing the same defect from being reported twice.

Labelling deficiencies are rectified immediately by affixing a temporary label. The OEEI team engraves a permanent label, which is then affixed by a member of the operations team in charge of the plant system with defective labelling, or by a member of the OEEI team (see paragraph 3.2).

In addition to reporting deficiencies, the operations department has also taken measures to address deficiencies raised during housekeeping inspections: approximately once a month during weekend shifts, outside of outage periods, operations staff rectify deficiencies placed under their responsibility. This system helps the operations department to keep the number of unaddressed defects to a minimum.

**IAEA comments:**

The operations department has a leading role in the plant-wide program, which was initiated by the plant management and aimed to improve the plant's material condition and housekeeping activity. This program is led and coordinated by the housekeeping team (OEEI).

The entire operations department management staff was trained on the principles of assessing the material condition and housekeeping and took the responsibility to communicate the plant management expectations towards the operational personnel. The operations department management aim is to reinforce the attention of the personnel to details and create the sense of ownership and accountability among them. All these changes are inevitable in order to reach a cultural change in the personnel's behavior, which at the same time guarantees long term success in this activity.

In realization of this task the operations management put special emphasis on improvement of the defect identification skills of senior field operators, and via them of the field operators using different tools, like management meetings, periodic field inspections, coaching of the personnel. In 2008, 92% of all revealed deficiencies by the operational personnel came from the field operators. Starting with the year 2005, this ratio has permanently increased. It shows the improvement of the effectiveness of the field operator's vigilance in detecting deficiencies.

Starting with 2005 the plant recorded more than 11.000 deficiencies up to now. From this amount of recorded deficiencies 3204 are still pending.

All operations staff members have put a great deal of effort into the industrial safety evaluation programme, launched by the plant management in 2006. By the end of 2008, more than 800 rooms will have been evaluated by operations staff.

The system for registering of the reported deficiencies in the field is fully implemented and well used by the staff. Deficiency tags installed are in most of the cases in a suitable form and adequate to the environmental condition of the technological rooms.

Observations during the follow-up mission tours and the available data confirmed that the adopted approach corresponds to the suggestion offered by the OSART mission. However during the field tours performed by the OSART follow up team several problems of defect identification or management were revealed, which are listed below:

Identification problems:

- Thermometer 1AHP027LT with a broken line in the measuring column,
- 1ABP003MN measurement with non transparent cover,
- Improperly fixed crane chain hanging and in contact with hand wheel of valve 1AHP048VV
- Lubricating oil dropping down from turbine deck elevation into a cable tray (Unit 1 turbine hall, elevation +5,5 m, next to 1ABP201BA drain recovery tank)
- Several broken and illegible labels
- Water leak with trisodium-phosphate deposit below valve 1APP103VN (Unit 1, feed water pump N# 1)

Managing problems:

- Fyrquel dropping down from turbine deck elevation and spreading on steam pipeline and pipeline hangers (Unit 1, turbine hall, elevation +5,5 m, next to 1ABP201BA)
- 6 priority 1 and 108 priority 2 overdue maintenance work requests

These facts indicate that there is room for improvement in enforcement of the vigilance of plant personnel to comply with the expectations.

**Conclusion:** Satisfactory progress to date

### 3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

**3.6(a) Good practice:** A “Fire Committee” including representatives of various plant departments analyses and implements rules and carries out inspections in the field.

The plant has set up a Fire Committee (“Commission Incendie”) composed of representatives of various departments and projects of the NPP’s organization (risk prevention, operations, site protection, mechanical and electrical, dismantling of Saint Laurent A, emergency planning and preparedness, fire action plan). This committee is headed up by the senior manager in charge of safety and quality department. Its secretary and animator is the fire officer, fire safety coordinator.

This committee is in charge of analysing and implementing new regulations and EDF corporate policies and operational experience related to fire prevention and protection.

The activities of this committee are:

- to conduct multidisciplinary activities,
- determine the priority of actions to be taken,
- define an action plan with relevant people in order make it easier to take into account prescriptions related to fire protection and improve “fire culture”,
- to carry out controls of activities related to prevention, training and fire fighting.

For these purposes, its members carry out systematic walk-downs in the installations at least twice a month. The deviations observed are documented and tracked.

The team considers that this committee is a powerful mean of disseminating in a practical way the fire protection concern in all departments of the NPP. Furthermore, the periodic walk-downs performed by a team of people having various backgrounds increase efficiency of these inspections.

## 4. MAINTENANCE

### 4.1. ORGANIZATION AND FUNCTIONS

An appropriate policy is established for maintenance with essential role in ensuring the safe operation of the plant. The plant main objectives are:

- to do what is strictly necessary at the best cost to ensure best availability for a minimum of forty years,
- plan and optimize the scheduling of maintenance actions,
- control the quality of maintenance work and monitor key points to their successful completion,
- maintain good quality relations with contractors and work together in a controlled partner relationship

Each maintenance department has defined goals and objectives. Contract efficiency is reviewed on the base of key performance indicators (KPI) regularly: monthly on the level of department staff and quarterly on the level of deputy plant manager. The KPI results are trended and posted on visible panels. Every morning, a short department staff meeting with the foreman is organized to inform each other of the main activities of the day. Also at the end of the working day there is a short meeting organized for feedback comments from the work field. The plant is encouraged to establish additional indicators to measure efficiency of maintenance activity, for example backlog of work request and amount of rework.

The plant has established organizational structure and responsibilities of departments during normal operation and during outage. This seems to be clear and understood by each department staff.

The plant's staffing during operation and outages is partially supplied by contractors. Before contractors are chosen to work on the plant, a special evaluation process of their habilitation is performed. Technical support center (UTO) is responsible for this process and also for updating national database of contractors (QUALINAT).

There is a very close partnership with other NPPs. Especially those from the Loire region have an interest to participate and draw benefits from the different projects and best practices.

In the maintenance field, the plant is strongly supported by EDF corporate entities. The nuclear operations division (DPN) supports the plant concerning national maintenance programmes. The corporate operation support center (CAPE) provides expertise. UTO provides support to the plant in the field of specific maintenance activities.

Interface with operations is effective on the basis of the Power Operation organization (TEF) during unit operation and AT project during outages. For both of these projects, representatives are appointed from several departments including maintenance.

The corporate QUALINAT database is a very good tool for the management of contractors. Partnership with contractors is contributing to the increase of contractors' qualification, quality of work, reduced time and dose rate as well as nuclear and industrial safety.

The interface with contractors and plant crafts is clearly defined, the responsibilities for work control are shared between the contractor supervisor and the plant work supervisor.

The habilitation and qualification of the plant craft is on a high level.

A pocket size booklet is issued to each craft which describes the common requirements everyone has to comply with at the plant. Forms covering each requirements are defined by a cross-functional work group, including maintenance, operations, radiation protection and field operators for optimal ownership. This is a good performance which improves everyday rigor and provides a document listing the requirements that each person within the plant has to comply with.

#### 4.2. MAINTENANCE FACILITIES AND EQUIPMENT

The size and arrangement of maintenance facilities promote safe and efficient completion of work. Facilities in the hot and cold workshops are adequate for work and they are accessible for maintenance.

The mechanical department keeps up to date the list of welding machines that are used for welding activity on safety related equipment. These equipment are checked every 6 months.

Each department keeps an up to date list of measuring equipment including voltmeters, torque wrenches and are maintained in good working condition. Calibration list is connected to this measuring equipment.

Torque wrenches are checked prior to them removal from the ware house. The hoisting rope, portable lifting tools and ladders are regularly checked prior to their removal from ware house.

The checking of these equipments and tools are visually marked by a plastic marker. Each year different color is used.

The lifting equipments are labeled visually by yellow label to monitor compliance with regulation in real time.

All tools issued by the warehouse are managed by a computer system and their traceability on the equipment are ensured by the maintenance work order.

During walk downs and field observation many of the pressure measurement gauges were found without calibration information. The plant noted that the technical MEMO No. 5072 defined a new maintenance programme for local pressure gauges connected to pressure vessels and other specific physical indicators. According to the technical MEMO No. 4802 gauges are included in SYGMA maintenance software. Next year the engineering support department must elaborate a local basic preventive programme (PLMP), to investigate the scope of local important indicators and the gauges which has to be checked and calibrated.

There are adequate facilities for decontamination in the hot decontamination workshop and they are maintained in good quality. The specific large tools and facilities are maintained using SYGMA database.

The maintenance of chemicals are removed from the warehouse prior to the maintenance work on the work order. However, unlabeled chemicals were found in the cold workshop.



In addition some deficiencies with maintenance tools were found:

The grinding machine had a dismantled protection glass on the left side. This was placed on the top of the machine. The machine was not properly cleaned.

#### 4.3. MAINTENANCE PROGRAMMES

The plant has established a maintenance programme on the level of preventive and corrective maintenance. The preventive maintenance programme for safety related equipments and systems are based on national EDF standardized preventive basic maintenance programme (PBMP). These standards are from EDF corporate Nuclear Operational Division (DPN) based on operational experience feedback. All EDF plants are required to send local maintenance and operational experience feedback to DPN for updating maintenance experience and standardization

The plant has implemented PBMP for safety related equipment and important equipment. The plant has also implemented local preventive basic maintenance programmes for equipment which are not included in corporate PBMP. Some equipment of both groups are covered by a condition based monitoring programme or witness equipment maintenance (choice of an equipment which represents an industrial model on which in depth maintenance is conducted). Some others are covered by a corrective maintenance programme. However, the real status of equipment indicates that local preventive maintenance programme has room for improvement. The team has made a recommendation concerning local maintenance programmes.

The history and records concerning the maintenance programme are maintained through engineering department, which has a link to DPN.

Condition based maintenance is part of the PBMP and prescribes the type of diagnostic methods, which are useful for the technical status evaluation of the equipment. If some predictive maintenance results show abnormal behavior, then the engineering department and technical committee will start processing the deficiencies to solve the problem. Feedback from this processing is used to change national programme.

As a part of main generator monitoring, a specific device called MIRAC has been introduced to measure insulation of main generator motor. The team identified this as a good practice.

Monitoring through visual walk downs and monitoring of leakages are part of predictive methods for condition based maintenance .

Any urgent and corrective work activities are subject to multidisciplinary pre-risk assessment between maintenance and operation. This analysis is guided and tracked by a specific document, the Risk assessment Sheet (GDE). While conducting urgent activities, this practice guarantees that a risk analysis is conducted. Also a discussion takes place between operators and maintenance crafts in the field of nuclear and industrial safety, radiation protection, environment and availability prior to the activity. The team recognized this as a good practice.

In service inspection (ISI) doctrine is a reference for plant ISI programme. The ISI programme for safety related equipments is covered by PBMP and PLMP. The plant

established a specific plan for pressurized equipment. Module PRV of SYGMA database is used for planning NDT activities.

A corporate EDF entity (CEIDRE) is performing technical monitoring concerning ISI at the plant. CEIDRE elaborate procedures for qualification of NDT methods which are approved by a qualification committee. The qualification reassessment of NDT inspectors is performed by an independent external body. The inspectors have specific qualification for each type of NDT method.

ISI results drafted in an assessment report by CEIDRE are reviewed if there is a real metallurgical defect. Procedures are clear, concise, and contain adequate information. Procedures and work instructions are periodically reviewed and updated. If required, further analysis is performed by CEIDRE.

ISI documentation is easily retrievable and archived. There is the ROZE database for archiving NDT results and protocols.

#### 4.4. PROCEDURES, RECORDS AND HISTORIES

Procedures are clear, concise, and contain adequate information. Procedures and work instructions are periodically reviewed.

Standard maintenance work procedures are clearly prescribed and maintained. Content is technically correct with step by step activities, drawings and with acceptance criteria. Database of maintenance procedures is available.

Work package and procedures contain adequate information for quality and safety work execution. Technical memo 4967 prescribed content of work package. In case of simple work for maintenance activities, it is not necessary to elaborate work procedures.

Procedures are updated according to plant and industry experience.

Maintenance control sheet was improved to facilitate the planning of corrective maintenance activities from expertise information collected in the field before preparing the work order. The team identified this as a good performance.

Technical and work history is kept in the SYGMA maintenance management software. This user-friendly software is a strong tool for craft personnel to manage work request, maintenance work preparation, execution and also history from maintenance works.

For systematic preventive activities the work order is generated automatically as a standard work order.

The experience feedback for activities of national importance is updated in the SAPHIR software national database which is connected directly with SYGMA's local database. SAPHIR database is useful for crafts to support information concerning the technical problems and events from EDF plants.

#### 4.5. CONDUCT OF MAINTENANCE WORK

The team recognized pre job meetings held before the start of work as a good performance. This practice has been developed from the efforts to improve quality of work performance and to avoid possible risks and conflicts with respect to principles of safety culture. A meeting before maintenance work is held by the foreman, in order to involve all members of the working group involved with the job by their active participation. This meeting allows the staff to share their personal experiences among themselves in order to be informed of what is expected from them, to be conscious of safety aspect and potential risks.

The quality of the plant's maintenance activities was not consistent. Maintenance activities are performed according to work packages including work procedures. The plant work supervisors are in charge of coordinating and controlling activities. The team recognized several examples with insufficient quality of works. In this area there is room for improvement concerning work supervision and the practices of workers. The team has made a suggestion concerning the quality of work.

The Foreign Material Exclusion (FME) program is developed and implemented. The specific FME procedure for steam generator and reactor exist. For other equipment the FME is a part of risk analysis sheet. The maintenance craft is regularly trained with periodicity of 3 years and the FME program and safety culture is a part of this training program.

Contractor's work is in accordance with a work package issued by plant maintenance craft. In case of specific activities, contractors prepare their own quality plan, or maintenance procedure which is approved by EDF staff. A contractor supervisor monitor checks the contractors' work.

#### 4.6. MATERIAL CONDITIONS

Several problems in the field were observed with respect to material condition such as valve and pump leakages, equipment corrosion and inadequate cable connections.

The plant established an action plan to increase housekeeping, painting, labeling and material condition with a target to reach international standards. Local procedures 0362 and 4635 prescribe the process and responsibilities. A training for workers, management, trade union representatives and also contractors was held before the start of the process. The 'Fix it now' team is in charge of coordinating this process on the basis of regular field reviews and meetings for assessment and deadline control. According to the DI76 and to the type of maintenance work completed on equipment and systems, the post maintenance activities and their associated criteria are jointly defined by operations and maintenance. Post maintenance testing is effective and tracked in the risk analysis. From the beginning of the project, the team identified 6364 deficiencies, 3611 of them are eliminated and 2753 are ongoing. This project seems to be a good way to improve material condition.

The plant's current action plan to reduce leak deficiencies started in June 2006. The aim of this action plan is to reinforce responsiveness to avoid recurrent problems with leaks by additional measures related to performing maintenance and improving operational crafts. The programme required equipment review with one month periodicity. Also the new training programme for tightening practices should be a support to reduce the leak problem.

#### 4.7. WORK CONTROL

Work is precisely prescribed in the work package and associated documentation. The priorities for corrective maintenance are assigned according to impact on safety and availability.

Work prioritization during operation of the units is done by the TEF project. The different daily meetings take place weekly on the bases of impact to safety and availability and define the priority P0 to P3. Some indicators are established to follow this process especially for the activity with priority P0 and P1. However, no specific indicators are established for corrective actions time measurement from work request issue until work completion.

Work management during unit operation is assigned by TEF cross-functional team. Some meetings are organized to prioritize corrective maintenance work. However, prioritization of non-urgent corrective activity backlog has room for improvement. The team has made a suggestion in this area.

The plant made an effort to ensure that the contractors follow the same approach to safety and quality of work as the plant. The plant contractor supervisor checks the qualification of participants, analyzes the quality plan of contractors, checks notification and hold points of quality plan before the work is carried out.

The plant established a new training programme for plant contractor supervision to increase the quality of this process before contractor start up the work, during execution of work, to follow up important points, and finally to document a report as a feedback and self assessment. This seems to be efficient to have an effective ownership by workers and contributes to enhanced supervision of contractor's work.

#### 4.8. SPARE PARTS AND MATERIALS

The UTO is responsible for the equipment and spare parts for the primary and secondary circuit manufactured on the basis of technical specifications drawn by EDF.

Adequate material management facilities are available. Environmental conditions and shelf life are adequately controlled. Safety related spare parts and materials are separated and traceable from supply to installation.

Storage facilities are adequate and controlled. Spare parts are kept in their package in accordance with technical requirements.

Storage of parts allows for timely retrieval and minimum damage. Stock levels are defined. Non-conforming or damaged spare parts are stored separately to prevent use. Parts are available to the plant when needed.

#### 4.9. OUTAGE MANAGEMENT

The outage cross functional organization is clearly defined and understood. The deputy plant manager is assigned as the outage project manager and representatives from different maintenance departments and shift operational staff are assigned to the outage team. Plant management has a strong commitment to the outage project.

There are several meetings conducted for outage monitoring and management. These meetings contribute to reaching the outage goals. There is a good opportunity during the craft coordination meeting to show and report the urgency, specific requirements and goals for the outage.

Risk analysis for work preparation is an effective tool and covers ALARA and waste reduction programme.

During the outage an independent outage safety committee (COMSAT) evaluates unit safety. Plant manager is in charge of validating change of reactor status according to the availability of equipment and systems required for safety.

There is an outage database in Lotus notes, which covers all information and reports concerning the outage. All crafts have access to this database.

Planning and scheduling for outage activity is an effective and strong tool for outage time reduction. It harmonizes the activities being performed at the same time. The schedule for critical path activity is updated daily according to the situation and daily outage team meetings are a strong tool for carrying out and following up each problem, on the basis of safety assessment.

The maintenance department is able to promptly set up structures to promptly deal with challenges in the area of nuclear safety, availability and cost. Technicians work extended periods of time, if the work is critical. That is a good performance on how to reduce outage time duration and unavailability of equipment related to safety.

The outage project defined modules like milestones for outage preparation phase. The outage preparation started 10 months before the unit shutdown with defining targets. The outage manager attends the production committee to report the state of the outage preparation phase. Different indicators are established for monitoring the main targets of the outage.

Every day, the outage safety engineer identifies 'key nuclear safety issues' for the next 24 hours. During a session scheduled in the daily meeting, he comments on these issues and gives a handout to the representatives of the relevant crafts. A reminder of 'key nuclear safety issues' is presented to each worker shortly before the beginning of his activity, based on a hardcopy document. The benefit for the worker is that he has full knowledge of what he is expected to do. The tangible benefit is the decrease in the number of events due to noncompliance with technical specifications. The results achieved were, 2001- 5 events, 2002 - 3 events, 2003 –3 events, 2004-1 event, 2005-0 event and 2006-1 event. This was deemed as a good performance.

## **SAINT LAURENT NPP FOLLOW-UP SELF ASSESSMENT**

The recommendation and two suggestions in the area of maintenance, combined with the managerial project mentioned in the MOA paragraph, have helped the plant to improve the standard of maintenance work.

In order to do this, the plant has implemented a number of consistent actions involving both engineering and other crafts. These actions include:

- Equipment health checks: in order to improve and adapt its maintenance programmes, the plant has defined a number of actions enabling it to conduct regular equipment health checks on equipment belonging to 10 key systems,
- Improved conduct of maintenance, by providing contractor supervisor with professional enhancement training as part of an overall oversight programme (supervision of outsourced maintenance and action plans to address substandard maintenance and resulting rework),
- Specific organizational measures, such as the setting up of a fix-it-now team within the power-cycle structure, which tracks overdue work requests.

These actions form a solid basis that will help the plant to start implementing AP913 in early 2009, a far-reaching initiative to which the French nuclear fleet has committed itself.

These site-wide actions have improved the conduct of maintenance and by doing so, have improved equipment reliability (fewer leaks, measuring instruments easier to read, better understanding of problem-solving strategies). They constitute a significant step forward in terms of nuclear safety.

## **STATUS AT OSART FOLLOW-UP VISIT**

One recommendation and two suggestions were made by the OSART team in the area of maintenance. The recommendation related to the situation where the EDF corporate maintenance programme did not cover all the plant maintenance to be undertaken at St Laurent. An action plan was developed consisting of six main actions and these actions resulted in approximately 50 systems being identified as being outside the current plant maintenance programme. The issue is considered as being resolved.

The first suggestion was for the plant to ensure that plant staff and contractors complied with quality rules and practices in order to achieve improved conditions of plant equipment and systems. The action plan developed for the issue consisted of four main actions which were enhanced oversight of contractors, skills learning and skills renewal of staff, human performance aspects and a leak management initiative. At the end of 2007, 217 leaks had been identified on site. To date, 71% of these leaks have been terminated. Between January and September 2008, a further 623 leaks were identified and 58% of these have subsequently been repaired. The increase in the number of identified leaks is attributable to increased plant staff reporting, even at very low levels of leakage. The issue is considered as being resolved.

The final suggestion for maintenance involved the timeous resolution of non-urgent corrective maintenance activities. The plant responded to this issue by addressing it on three fronts. A specific Fix-It-Now (FIN) team was set up, prioritisation of work requests were readdressed and maintenance windows were set up to allow specific maintenance activities and work packages

to take place while the unit was online. Backlogs of activities are monitored by specific indicators and discussed on a weekly basis at the Production Meeting, chaired by the Deputy Plant Manager.

There are currently still over a hundred overdue maintenance requests in the system and the plant acknowledges that there is still some way to go to fully resolve this issue i.e. reduce the backlog to a more realistic level but the team considers that satisfactory progress to date has been made on the issue.

## DETAILED MAINTENANCE FINDINGS

### 4.3. MAINTENANCE PROGRAMMES

**4.3(1) Issue:** Some plant equipment are not sufficiently covered by plant (local) maintenance programmes.

- Pump 0ASG004PO, in auxiliary demineralization station, has a leak coming from its seal to the floor. Preventive maintenance QS programme, 1 per year. Oil change in reductor was performed in August 2006.
- Pump 1SRI002PO has leakage and deposit. Stuffing box collector modification was performed in July 2006.
- Valve 2APG 009 VL has no preventive maintenance, it is a steam generator draining system with leak and corrosion.
- Valves 2CEX011VL, 2CEX010VL, 2CEX009VL in the turbine hall, there were three oil leaks coming from flanges, and oil absorbers for oil drop collection were still missing
- 1AHP 058 VL valve – HP feedwater heater system – no preventive maintenance, in January 2005 oil leak was repaired and stuffing box was tightened, oil leak is present now.
- The motor of the motor-operated valve 0KER207VE, in RCA outside building, liquid radwaste discharge system. No preventive maintenance, 1998 visit.
- 1DEG230VD valve is strongly corroded located in the nuclear auxiliary building.
- There is corrosion on the support structure of pump 2RRI 002PO in the nuclear auxiliary room no. NF362.
- The guide tubes on instrumentation cables are damaged and corroded - CC system in nuclear auxiliary room No NF263.
- 1ABP302RP pipeline insulation was corroded.

Without an appropriate scope of preventive or condition based maintenance programmes, unacceptable degradation of equipment or systems might occur.

**Recommendation:** In order to improve the general condition of the equipment the plant should enhance local maintenance programmes for equipment not included in corporate maintenance programmes.

**IAEA Basis:** NS-G-2.6; 2.3(c)

“Planned maintenance activities should be performed prior to unacceptable degradation or equipment failure and may be initiated on the basis of results of predictive or periodic maintenance, vendor recommendations or experience”.

NS-G-2.6, 2.6 ‘A systematic approach to evaluation should be taken to establish which maintenance tasks are to be performed, on which SSCs, and at what intervals, in order to optimize the use of resources allocated for maintenance and to ensure the availability of the plant. This approach can be used in establishing a preventive



maintenance programme and for optimization of the ongoing maintenance programme.”

NSG 2.6, 2.7 “The operating organization should monitor the performance or condition of SSCs against the goal it has set so as to provide reasonable assurance that the SSCs are capable of performing their intended function”.

**Plant Response/Action:**

A review of our maintenance programmes has revealed that our corporate programmes do not exhaustively cover all items of equipment.

A number of actions have been taken to improve equipment condition with a view to enhancing plant safety and availability:

- Periodic health checks on the most important equipment with input from maintenance and operations, with a review of external condition and past performance in order to define necessary maintenance actions to supplement current programmes.
- Implementation of a leak reduction plan by the mechanical maintenance department in order to significantly reduce the number of visible leaks. This plan required considerable effort during outage and 30% of the leaks identified at the beginning of the year have been addressed on unit 2.
- Management of level-2 work requests is being improved and work backlogs are being reduced thanks to the setting up of a fix-it-now team (EDIR): work requests are currently being reassigned and outstanding work requests are currently being re-prioritized by the power-cycle structure, by creating maintenance slots in the cycle schedule.
- Quality of maintenance work has been improved by setting up a contractor oversight structure, essentially during outage, and by capturing experience feedback from previously encountered difficulties.
- An initiative is underway to check equipment condition prior to maintenance. This initiative is headed up by the mechanical maintenance department in liaison with the power-cycle and outage structures, with support from the OEEI team. Maintenance jobs have already been defined: unit-2 main feedwater pump, cooler units, CVCS pumps, FAC on fire-protection systems, feedwater plant and demin plant.

**IAEA comments:**

It was recognised that the corporate maintenance programme did not cover all the plant at St Laurent. An action plan was developed consisting of six main actions. These were the preparation of equipment ‘health’ reports on the major systems and determination of key equipment, specific differences identified between the corporate and St Laurent specific maintenance programmes, an equipment refurbishment programme was undertaken, a leak management programme was initiated, improvement of the work request prioritisation scheme was undertaken and enhancement of maintenance quality practices.

The above actions resulted in, inter alia, approximately 50 systems being identified as being outside the current plant maintenance programme. An analysis of operating experience of equipment with a history of problems was also undertaken.

**Conclusion:** Issue resolved

### 4.3. MAINTENANCE PROGRAMMES

#### 4.3(a) **Good practice:** Risk assessment organization for urgent activities.

Risk analysis for urgent situation that have impact on safety and availability is started immediately by deputy shift supervisor, while the appropriate technicians from an on-call system travel to the plant. With this method, the plant reduces the unavailability of the equipment (thereby improving safety) and reduces the overall unavailability of the installation.

The overall aim of the risk analysis is the need to prompt and track a multidisciplinary risk analysis between maintenance and operations prior to an urgent activity.

While conducting urgent activities, this practice guarantees, that a risk analysis is conducted, and that a debate takes place between operators and maintenance crafts in the fields of nuclear and industrial safety, radiation protection, environment and availability prior to the activity.

The findings of the analysis and the activity are tracked.

This document illustrates the professionalism and safety culture applied by workers.

Benefit for the plant is to improve control of urgent work activities.

Operating experience sharing with other plant in the field risk analysis

#### 4.3(b) **Good practice:** As a part of main generator monitoring, a specific way to connect device called MIRAC has been introduced to measure insulation of main generator rotor by reducing risks.

The device measures rotor isolation during operation. Since it is not part of original design, no connection is available to fit the MIRAC to the main generator exciter system. Using the suggested way of connection, an interface box was installed permanently to connect the MIRAC device thereby minimizing the risks. Using the suggested connection, this measurement of rotor insulation was successfully implemented.

Benefit for the plant:

- Reducing the turbine trip risk therefore reducing potential reactor scrams by creating an interface box (including a mounting panel with fuses and circuit-breakers) and also avoiding short-circuiting the ground rotor.
- Increasing industrial safety: the interface box enables to minimise risk associated to a high-voltage connection (secured plug, anti-flash with reinforced insulation).
- Implementation of a condition based maintenance programme; with a safe plugging activity, it is now possible to take a monthly measurement therefore allowing the early detection of potential defects

#### 4.5. CONDUCT OF MAINTENANCE

**4.5(1) Issue:** Some maintenance activities are not performed in accordance with industry standards and plant quality expectation.

- Leak from shaft seal of valve 1RIS085VB in fuel building room level 10,5 m safety injection system. There was water and deposit on the flange and on the floor. Leak exists at the moment and seems to be old. Corrective activities were done on 23/11/2006 to tighten the stuffing box.
- Valve 1EAS131VB has leak coming from shaft seal packing, there is build up of boron deposit on flange and flange bolt. In 2006 preventive maintenance was done.
- Pump 2RCV003MO in auxiliary nuclear room No. 235 has leakage coming from the seal. Pump is included in the maintenance programme, small maintenance was performed in November 2006.
- One bolt of the main flange of orifice plate 9TEP035DI (Boron recycles system) was broken with the nut lying on the main flange. In SYGMA it shows that in 1998 a 10 year inspection was conducted. Valves associated with sensors 9TEP470YP and 9TEP472YP are not in SYGMA and one of four flange bolts was missing.
- About 25% of main flange bolts of pumps 1SEC003VE, 2SEC003VE are incorrectly assembled, the nuts are not engaged at full length of the bolt. In SYGMA there is no information concerning 1SEC003VE. 2SEC003VE was repaired in 1999. This activity was performed by contractor and validation was performed by a plant supervisor.
- A contractor performed with insufficient professionalism during a diesel generator oil filter replacement.
- Concerning the scaffolding built near the heat exchanger 2AHP04RP, one of its legs was placed near the valve 2AHP068VL and touching it. This potentially prevented the operation of this valve.
- Temperature sensor 1SRI003LT has unsatisfactory quality cable connection.
- Remote control panel not fixed properly to wall. Cable was wrapped around room BK216
- Actuators 0ASG150VD and 0ASG158VD had its electrical cable not connected and insulated.
- Pump 1DEG006PO has a oil leak under the pump.
- 2ASG001PO oil under auxiliary feed water pump in electrical building, last visit November 2006
- In the demineralization station, the pressure gauge mounted on the OSDP011FE is not correct, it does not have the right scale.
- Sensor 1CEX 005 MT has a broken cable duct and pump 1CEX 001 PO has oil leakage and dust. The preventive maintenance was performed in August 2006.
- Inappropriate management control, supervision and work practices of workers is contributing to weaknesses and to the insufficient quality of maintenance works.

Inappropriate quality of maintenance activities may result in equipment degradation or failures, which can affect plant safety.

**Suggestion:** Consideration should be given to ensure that plant staff and contractors comply with quality rules and practices to achieve better condition of plant equipment and systems.

**IAEA Basis:** NS-G-2.6:

5.14. “A comprehensive work planning and control system applying the defense in depth principle should be implemented so that work activities can be properly authorized, scheduled and carried out by either plant personnel or contractors, in accordance with appropriate procedures, and can be completed in timely manner”.

6.7. “Once an activity for MS&I has been completed, the results should be reviewed by a competent person other than person who performed the activity. The review should establish whether the activity was appropriate and was properly completed, and should provide assurance that all results satisfy the acceptance criteria.

NS-R-2: 6.7. “A comprehensive work planning and control system shall be implemented to ensure that maintenance, testing, surveillance and inspection work is properly authorized and is carried out in accordance with established procedures.

**Plant Response/Action:**

The plant has continued to implement its improvement plan by significantly stepping up contractor oversight during maintenance. 100 people have been trained in contractor supervision and the plant has appointed between 30 and 60 contractor supervisors or deputies to ensure that maintenance is properly performed. Contractor oversight programmes incorporate feedback from similar types of maintenance work.

In 2008, special coaching was provided by the departments and plant senior management in order to improve maintenance quality.

The action plan is tracked on a 6-monthly basis and is submitted to corporate offices, together with the improvements achieved.

In addition to these extensive efforts and as part of the human performance project designed to reduce human error and failure, more specifically through the use of department monitoring plans, the plant has stepped up management presence in the field in order to check and provide coaching in the use of error reduction techniques (pre-job briefs, time-out, three-way communication/repeat backs, peer checking, self-checking and post-job critiques). Staff members have been given training in the use of these techniques.

**IAEA comments:**

The resolution of the issue was addressed by the plant in the form of improving the quality of maintenance activities. The action plan developed for the issue consisted of four main actions. These actions were enhanced oversight of contractors, skills learning and skills renewal of staff, human performance aspects and a leak management initiative.

The enhancement of contractor overseers included specific training for the particular oversight responsibilities of the individual and coaching of the individual by his line

management. This has resulted in a tighter organisational control of the work of contractors.

An area of about 250 square meters has been assigned to a maintenance mockup area where new trainees, contractors and qualified artisans can receive training on various aspects of maintenance activities undertaken in the field.

Human performance aspects include increased and documented management presence in the field (a minimum of four documented visits per month is required), enhanced error prevention techniques and the systematic analysis of near misses and low level events, specifically with respect to maintenance on site.

The number of identified leaks on the plant can give some indication of the quality of maintenance activities undertaken on the particular plant items. At the end of 2007, 217 leaks had been identified on site. The main contributors to the leaks were found to be ageing of valve seals, gland packing and some design flaws. To date, 71% of these leaks have been terminated. Between January and September 2008, a further 623 leaks were identified and 58% of these have subsequently been repaired. The increase in the number of identified leaks is attributable to increased plant staff reporting (previously, plant staff reporting of leaks was very low owing to cultural aspects), even at very low levels of leakage.

**Conclusion:** Issue resolved

## 4.7. WORK CONTROL

**4.7(1)Issue:** Some non-urgent corrective maintenance activities with priority P2 to be performed in one month are not performed within the time limit requested by operations.

- High pressure reheaters relief valve 1AHP054VL has a leak through the valve. The leak was identified and work request with priority P2 (to be repaired in 1 month) was issued on 4 August 2006. Instead of repairing a work order was issued on 9 November 2006 to perform repair in the 22nd annual outage of unit 1 in 2007. When questioned why the reheater was not depressurized and relief valve replaced or repaired, the answer was that the relief valve has a design/ structural problem and the repaired valve would also leak after its first actuation. It was also explained, that the same valve on unit 2 is also leaking.
- Pump 1GSS002PO has a water leak through its casing. The leak was identified together with an oil leak and a work request with priority P2 was issued on 5 September 2006. The oil leak was repaired on 6 September, but the water leak continued. The water leak was not repaired by 5 October due to high workload of priority 0 and 1 works. From 5 to 25 October, the repair could not be done because pump 1GSS001PO was on major maintenance. Due to these reasons the deadline identified by priority P2 of the work request could not be met. However, three months after identifying the leak, no new deadline for repair has been set as yet and the work order is not prepared.
- Corrective actions backlog from 1.1 2006 till 30.11.2006 is high:
  - In the mechanic field – from a total number 2084 work requests, 516 are planned for the next outage and 560 are not finished in TEF project / for IPS equipment, 84 with category P2.
  - In the electric and I&C field – from total number 2718 work requests, 371 are planned for the next outages, and 457 are in different phases but not finished in TEF project / 75 category P2.
- Water demineralization station: There are 11 leaks at the seals of flanges, manholes in the make up water system from 29.12.04, 14.02.05, 24.04.06, 01.09.06 with time as soon as possible. Six work request for maintenance of the effluent treatment pool from 15.12.05 and 01.03.06 and they are still not completed.
- Plant has not created specific backlog indicators, which specify time duration from work request issue until completion of work.

Untimely repair of equipment may contribute to potentially more serious damage and unavailability.

**Suggestion:** Consideration should be given to complete non-urgent corrective maintenance repairs with category P2 in the time frame requested by operations.

**IAEA Basis:** INSAG 15, -3.5

“Nearly all events, ranging from industrial and radiological accidents, incidents and near misses to failures affecting nuclear safety, start with an unintentionally unsafe act

or an unacceptable plant condition or process. These have often been latent and have gone undetected or been treated as, custom and practice, and therefore been ignored. Then, in combination with another challenge to the system, a further more significant failure occurs. Minimizing existing latent shortcomings in working practices or plant conditions is therefore vital in avoiding more serious event”.

### **Plant Response/Action:**

In order to reduce response times for non-urgent maintenance items, the plant has set up a fix-it-now team (EDIR).

Consisting of members from both operations and maintenance, this multi-disciplinary team is responsible for performing a detailed analysis of work requests in order to facilitate prompt response. When maintenance has little impact on the process, the team carries out the work directly. If this is not the case, it submits a comprehensive investigation to the power-cycle structure, enabling it to free up resources for the planning of more complex activities.

This team’s investigation and work permits are compiled by shift teams either overnight or during weekends. A simplified risk assessment is performed for each investigation and maintenance job. Owing to their negligible impact on the process, these activities are not included in the schedule. EDIR teams start work on the morning of the very first working day, in direct liaison with the duty deputy shift manager, following a telephone brief at 7.45 a.m. They report directly to him.

The EDIR team was put together on the basis of investigations conducted by operations, mechanical maintenance and electrical maintenance, using information gathered from plants already equipped with this type of team. The project was approved by the power-cycle structure on 20/09/2007. The EDIR structure is described in a procedure referenced PRO 470.

The setting up of this team has helped to reduce the number of level-1 work requests by about 40%, and the number of level-2 work requests by about 50%.

Furthermore, an action plan overseen by the head of the power-cycle structure was initiated in 2007 to work down the maintenance backlog.

Deadline-based priority levels have been replaced by priority levels based on consequences for the plant process. Level-2 work requests are now work requests having an impact on the process, while level-3 work requests have no impact on the process.

This new system was accompanied by an exhaustive review of level-1 and level-2 work backlogs, in agreement with operations shift teams. The amendment logic for these priority level changes is recorded in Sygma.

All these actions have helped to reduce the number of level-1 work requests to 10 and to divide by 3 the number of level-2 work requests (from 300 to approx. 100) before the start of the 2008 outages.

### **IAEA comments:**

The plant responded to this issue by addressing it on three fronts. A specific Fix-It-Now (FIN) team was set up, prioritisation of work requests were readdressed and maintenance windows were set up to allow specific maintenance activities and work packages to take place while the unit was online.



The FIN team has allowed rapid but measured interventions to take place on the unit i.e. they have not only helped in the diagnosis of problems from a multidisciplinary perspective but have also undertaken the work activity as well.

Level 2 work requests are not now assigned a time limit of one month. The time limit for resolution is determined as a result of discussion between the maintenance department and operations. An upper time limit of within one operating cycle is established for resolution of the activity.

Backlogs of activities are monitored by specific indicators and discussed on a weekly basis at the Production Meeting, chaired by the Deputy Plant Manager.

There are currently still over a hundred overdue maintenance requests in the system and the plant acknowledges that there is still some way to go to fully resolve this issue i.e. reduce the backlog to a more realistic level.

**Conclusion:** Satisfactory progress to date

## 5. TECHNICAL SUPPORT

### 5.1 ORGANIZATION AND FUNCTIONS

Technical support competences are distributed across several technical departments of the plant with strong support of corporate services. The plant organization follows the doctrine of EDF and so it is similar to the other French plants.

The main departments involved in technical support activities are the Project and Engineering Department (SIP), and the Safety and Quality Department (SSQ), but several other sections or departments are involved in specific technical support activities in coordination with SIP and SSQ. Although the departments or plant sections involved in technical support activities are not under the same line of management, the technical support functions are under the supervision of the Chief of Technical Mission, who is one of the senior advisors to the Plant Manager and exercises the coordination of the plant departments involved through the plant Technical Committee (CT). The plant organization, interrelationships, department competences and their role in technical support is established in a series of plant management notes which are well understood by the plant personnel. A cornerstone for the accomplishment of technical support functions is the support provided by corporate services of EDF belonging to the Direction of Nuclear Power (DPN) and the Direction of Engineering (DIN). The interface with the corporate organizations is clearly established through the SSQ and SIP.

Plant sections and departments dedicated to technical support functions are well staffed for their regular duties, emerging issues and preparation of outages and modification programmes. The plant has established the qualification requirements for carrying out the different technical support activities. These qualifications, which are in the line of plant and corporate polices, require high levels of professionalism and expertise. For this purpose a suitable training program is established for the acquisition and maintenance of competences for the different type of posts. The regular workforce is reinforced through the participation of the external corporate organizations when required. Contractors are used when projects exceed the technical capabilities or resources of the local and corporate organizations, such as the change of steam generators and steam generator inspections. The external organizations select in such case the contractors. Technical competence is the key aspect for the selection. Contractors have to adhere to quality assurance and qualification requirements of EDF. The plant supervises and evaluates the work of contractors and provides feedback to the national organization.

The technical support organization is safety performance oriented, and its effectiveness is regularly monitored by the plant management.

Technical support is a cross-departmental function and collaboration is encouraged, supported and exercised by the senior management through well established responsibilities, decision organs (safety committees) and communication. The plant management is promoting and encouraging a policy for presence of the managers on the field, which is reflected in written. The chief of technical mission exercises its management of the different departments involved in technical support through the committees, principally the CT. Lower level managers, department and section heads have demonstrated close contact and familiarity with the practical technical support work. This could be observed in presentations and during the briefing and debriefing activities in connection with the observations in the field.

## 5.2. SURVEILLANCE PROGRAMME

The reference basis for the surveillance programme is established at the corporate level, laying down the most safety relevant surveillance test requirements, principally those related to the plant technical specifications, which are approved by the Nuclear Safety Authority (ASN). The Safety and Quality Department (SSQ) of the plant has the responsibility for adapting the corporate surveillance requirements to plant specific requirements. In doing so, it accounts for the specific conditions and can formulate additional requirements or apply for exemptions justified on a case by case basis, exemptions need approval of ASN. The SSQ coordinates the programming and execution of the surveillance activities, which is performed by the competent plant sections, mainly operation and the maintenance departments. These departments have also the responsibility for elaboration verification and approval of the plant specific procedures related to the test. Review and approval takes place within the line of management of the service. This arrangement gives opportunities for customizing the process to the specific aspects of the field of work, but also to introduce divergent or not homogeneous practices in the different technical departments involved. The team has made a suggestion concerning the surveillance tests.

A systematic and comprehensive analysis programme of plant transients is carried out aimed at ensuring that normal and accidental operations do not surpass the limits established in the design. In a few cases the number of transients occurred with respect to the number of acceptable transients for the whole plant life are already about 50%. One reason has been a high number of transients during the plant start up test period. Later on, the frequency of transients has been significantly reduced. In other cases, too conservative limits were set and after licensing new limits performance has substantially improved. In addition, the plant has adapted the simulator training program to put emphasis on operational practices that had led to a high number of transients, such as the operation of the volume control system.

## 5.3 PLANT MODIFICATION SYSTEM

Modifications are analyzed, developed and implemented by the engineering modification service of the operating plants (SMIPE). SMIPE is integrated by local staff of Saint Laurent NPP and corporate groups of the DIN and DPN. Most of the modifications are conducted at national level for the 900 MW fleet. Important modifications specific of Saint Laurent are also handled as national modifications, and therefore carried out through the corporate organization. A very minor set of changes and with low importance are dealt with by the site team. Nation wide modification are first implemented at one site and after a satisfactory experience are implemented in the rest of the fleet. The plants have established several efficient systems for interchange of experience about modification and benefit in this way from important advantages of strong and knowledgeable corporate support organizations, design standardization and interchange of experience. A systematic assessment of the modification is carried out, taking into account the safety significance by the corporate engineering groups. SMIPE has implemented a hand-over process of modifications to the plant aimed at enhancing customer's satisfaction. The inconvenient aspect of this nationwide modification process is its long duration.

EDF has a policy for minimizing plant specific modifications and aiming at high levels of design standardization. Within this policy, requests for modifications are analysed and approved at corporate level according to a well established process, which depending on a

categorization for safety significance, defines also the interaction with the ASN. Once approved modifications are grouped in batches to the extent possible and implemented in the so called First of the Series Plant. Only after a satisfactory experience feedback from this plant, the batch of modifications is installed sequentially in the rest of plants of the same design fleet. In practice, this means that a corporate plant modification may require from five to ten years from decision to implementation. There is a faster process which is applied if the modification is needed to address more important safety issues. In this process modifications are not treated in batches and are not implemented sequentially in the plants. However, this faster process takes also several years as observed from the modifications currently undergoing it.

Safety assessments of design evaluations are developed at the corporate level and available at the plant by demand. The plant receives a work package well in advance, which includes the new details of the modification for its implementation, all applicable changes to the plant documentation. The process for handing over the modification is customer oriented, and gives consideration to specific plant request to the extent possible. SMIPE leads the implementation of the changes, usually with the assistance of contractors. Other plant departments are responsible for updating surveillance procedures and other documents maintained at the plant level for reflecting the modification. It should be remarked that this internal plant implementation process causes additional delays, since some planned modifications are deferred to the next year or unit outage. The review team would like to encourage the plant organization to take the necessary measures to minimize such delays and avoid making the time for performing plant modifications even longer .

In parallel to this process, there is a process for temporary design modifications. These are limited to the extent possible in number and time. However, some design modifications are in place for a long time. In any case, a systematic analysis of the impact of temporary design modification on nuclear safety, radiation protection, occupational safety and plant availability is carried out as a part of the approval process. Temporary modifications have a distinctive tagging and identification system which allow their recognition in the field. The control room shift manager authorizes the implementation or elimination of design modifications and maintains a register of them. This register is reviewed every month by the Shift Manager of Operation and the number of temporary modifications is monitored. There is an important number of recurrent temporary design modifications. These are modifications that need to be implemented for a short time during refueling outages for performing specific operations or tests. For some of these modifications, changes are made included in system diagrams, operating procedures and other documents. Temporary modification in plant software are not allowed.

The plant departments requesting design modifications maintain a database with all the modification details and are responsible for conduction functional tests after installing and removing the modifications.

The current number of design modifications is low and plans for removal or incorporation to the design are quoted in the register maintained by the shift in some cases. However, there is not a maximum time fixed as a goal by the plant for design modifications or requesting them to be permanent to the corporate services. There is overall a good control of temporary design modifications.

## 5.4 REACTOR ENGINEERING

Reactor core analysis and preparation of the fuel cycles are made at the corporate level by the Fuel Branch of UNIPE, based in Lyon. They provide the core map for the cycles and make the manufacturing requests. The plant sections in charge of fuel activities perform all the plant surveillance activities related to the core and fuel pool operation. This includes an extensive measuring and monitoring of the core variables during the fuel cycle, and very importantly all the physical test for plant start up after refueling. This process is carried out by the technical department (ST) with assistance of the neutronic experts of SIP and the support of UNIPE. The process entails the validation of the core calculations, measurement of important parameters, such as reactor coefficients, reactivity measurements, and verification of design and safety criteria and calibration of the nuclear instrumentation.

During power operation, a regular monitoring programme and adjustment of the core instrumentation and control rod values. A similar monitoring process is also implemented for the stretch out operation. For these purposes the thermal balance of the plant is used as a reference. Due to the important safety implications of these controls, a safety and quality plan is put in place at the plant, which involves the participation of the engineering, ST and operation departments and several levels of verification, i.e. controller, supervisor, coordinator of the safety and quality plan and Chief of Operations. The plant has also implemented also a programme for refreshment training and specific training of the staff involved in these activities.

A detail yearly report describing the operation of the core is produced, which describes all the evolution of relevant parameters, incidents occurred includes the analyses of experience and performance.

## 5.5 HANDLING OF FUEL AND CORE COMPONENTS

The plant undertakes all the fuel operations in the plant from fuel reception until preparation and shipment of spent elements. This process involves many plant departments. The organization and assignment of responsibilities is clearly established and well understood by the sections involved. It also includes the interfaces and relations with corporate services of EDF (UNIPE and DCN), national authorities (IRSN) and EURATOM.

The plant has established an integrated process for managing all fuel handling activities. The process, which entailed the improvement and integration of four existing processes has led to a remarkable enhancement of safety performance. This positive safety brought the following benefits:

- No reportable events at the plant (both units) since 2001.
- Enhanced calibration of sensible core measurements;
- Implementation of strict controls of movable parts to minimize the risk of any foreign material falling in the fuel ponds.
- Reduction of personnel doses in the evacuation of spent fuel from 6 to 3.5 mSv

The elaboration of this integrated process has been a collaborative effort of all the plant services involved in fuel activities. In the course of the review of the previously existing process and practices, the taskforce analysed thoroughly the problems in the field, elaborating proposals and agreeing on solutions. A system of safety performance indicators was

established and is being monitored for verifying the safety improvement on all fuel related activities.

A thorough process is used for accounting nuclear fuels and track the full history of any core element (fuel assembly, control rod, etc.) arrived at the plant. Official records are complemented by a software system which facilitates to know the core and spent fuel map as well as all positions and movements of core elements, their current composition and the conditions under which it was operated. Capacity and occupancy of the fuel pool is by far sufficient to unload the core in any circumstances if necessary. Radiochemistry control is performed regularly to identify degradations of the first barrier. The WANO chemistry index is minimum, denoting excellent fuel condition and clean primary circuit. Provisions are in place in design and operation to unload and test fuel assemblies to identify defective elements.

There is a meticulous control of movable parts, tools, personal ware, disposable materials, etc. to minimize the risk of any foreign material falling in the fuel pools. Other areas of fuel transit or manipulation require specific permit and the pool area is strictly controlled by physical security. Adequate measures are also in place to maintain low levels of contamination.

The plant has implemented an advanced video surveillance system for fuel loading and movement surveillance together with optimised procedures for fuel manipulation, which account for human reliability and human factor aspects. This has been considered as a good performance and is aimed at minimizing the likelihood of any loading mistake, since there have been some incidents of this kind in EDF.

Certified fuel operators receive in addition extra training, which includes fuel operation practices on a research reactor facility.

## 5.6 COMPUTER BASED SYSTEMS IMPORTANT TO SAFETY

There are 216 computer applications at the plant, from which 2/3 are corporate application. The plans for the plant are to reduce to the extent possible the number of local applications. The applications are hosted in an interconnected system of local and remote servers. Industrial software that affect the operation of the plant are independent from the network. Any software, local or national undergoes a safety and security classification analysis. Three safety levels are established depending on the foreseeable impact on safety according to national norms (IN26). There is an additional category for software without safety relevance. There is no software of the most critical category. Every piece of software is systematically analysed through established process and procedures. It includes the development of a kind of event tree describing which consequences the failure of the software may have. National software is not modified at the plant. Validation and verification is done at corporate level. For local software, validation, verification, requirements for documentation, data integrity, etc. are established and controlled according to the safety classification. Needs for securing access to application, permissions for changing data, verification and tracking of data changes, etc. are made according to the norm DI64.

The plant makes a thorough use of these norms and except for industrial applications associated to the process, all applications are installed in the common servers and network, with access and integrity from any post through strict application of security measures.

Software programmes, document data bases are interconnected, thus avoiding updating problems and inconsistencies, e.g. connection of dosimetry with personnel data.

Data integrity is ensured by regular back ups of the servers and secured storage of the copy. Any provider of safety classified software is required to provide an emergency support in an stipulated limit of time. Paper records are maintained for safety relevant applications for its use in case of hardware/software failures.

For any validated local application every department has the responsibility for its maintenance. Maintenance of national software is the responsibility of the common service GSI and RSI for the information systems

### **SAINT LAURENT NPP FOLLOW-UP SELF ASSESSMENT**

The suggestion in the area of technical support has been implemented.

In concrete terms, this has been done by reinforcing the surveillance test process over and above the document process, which has now been standardized throughout the fleet through the closely coordinated scheduling of tests both during outage and the power cycle.

Secondly, a comparison has been drawn between trending practices and the second-level analysis of test results.

The first point, achieved through an improved tracking process, and the second point, achieved through the clarification of organisational structures and strategies, have helped us to improve nuclear safety.

### **STATUS AT OSART FOLLOW-UP VISIT**

A comprehensive effort of reviewing surveillance test procedures was completed by the plant as part of the EDF-wide project of harmonizing practices and methods. The periodic revision process of these procedures has also already started, so these are sustainable achievements.

The different methods of trending and analysing the surveillance test results applied at different organizations of the plant were compared, best practices to be applied consistently throughout the plant have been selected. However, the transition to these unified methods in some organizations is still in the phase of implementation or being planned, awaiting the introduction of new computer applications.

## DETAILED TECHNICAL SUPPORT FINDINGS

### 5.2. SURVEILLANCE PROGRAMME

**5.2(1) Issue:** The process for handling deviations in the surveillance test programme is not always applied systematically. Plant sections have responsibility for implementing their part of the surveillance test programme, including the development of procedures and analysis of results, and there is little interchange of experience between them. This has led to deviations and differences in performance.

The team became aware of several deviations or inadequate practices in the implementation of the surveillance test program during the review:

- In the realization of the surveillance test procedure RIS 121 on 20.6.2005, handwritten changes were introduced and signed to approve a deviation from the procedure. The procedure was not changed and it was executed again in June 2006, adding handwritten modifications without quality control (date and signature).
- On the same day, the surveillance procedure EAS011 was also executed with signed handwritten corrections. However, this document is still unchanged and no updating process has been initiated.
- Test procedure ASG 043 does not address the need for the operator to check the activation of three red alarm signals (2ASG401AA, 2ASG402AA 2ASG403AA) originated by the test. The deficiency had not been identified since the procedure was issued in 2005, without undergoing a validation process.
- Vibration tests of the high pressure safety injection pumps shown incipient degradations below the limits of acceptance for the test, but only after repetitive tests with similar results a deviation sheet was filled out.
- Test procedures issued by different sections analyse in a different manner the risk implications (plant safety and availability, radioprotection, etc.) of carrying out surveillance test procedures. These procedures are reviewed and approved within the section or departments in charge of carrying out the tests. Analysis of results and trend analysis is not carried out with the same level of detail by all the sections involved

Without a common approach for preparing, executing and verifying the results of surveillance testing, there is potential for a reduced efficiency of the safety functions of the plant by failing to detect inoperability of safety equipment and not minimizing the impact of test interventions on safety.

**Suggestion:** The plant should consider enhancing its control and review of surveillance testing process for issuing, validation and approval of associated procedures in order to avoid negative impacts on safety. The plant should also consider comparing and benchmarking the plant practices for analysing and trending



the results of surveillance testing and implementing them consistently in all the sections.

**IAEA Basis: NS-G-2.6:**

4.3. “Documentation, procedures and records deriving from the MS&I programme should be managed in accordance with extant arrangements for quality assurance.”

6.12. “Historical records of MS&I should be periodically reviewed and analysed in order to identify any adverse trends in the performance or equipment or persistent problems, to assess impacts on system reliability and to determine root causes.”

**Plant Response/Action:**

As part of the procedure standardization project (PHPM), all departments’ surveillance test procedures falling within the scope of General Operating Rules (completed for operations, in progress for I&C, testing and mechanical maintenance) have been standardized across the entire French fleet. Plant systems have been divided up among plants belonging to the same reactor series. Surveillance tests are written by one plant and reviewed by another. Final approval is granted by corporate level, with support from corporate engineering structures. Following completion of the PHPM project, procedures and corporate OE are monitored by the IOP (operational engineering) structure.

Furthermore, the operations department has improved its surveillance test arrangements by focusing on two key aspects:

1: Power-cycle surveillance schedule and performance checks

Scheduling checks have been improved by cross-comparing the various scheduling systems (OPX2 for maintenance activities and PRV for operations surveillance tests). This comparison is made by two separate individuals who then cross-check their results. Shift managers are provided with a weekly schedule of tests due to be performed.

This schedule is filled out and signed by shift managers during each shift.

On Monday mornings, the filled out schedule is retrieved by the power-cycle off-shift structure, which checks that nothing has been left out. Deficiencies are rectified.

The off-shift power-cycle structure conducts a weekly check using the PRV database to ensure that surveillance tests have been performed.

2: Outage surveillance tests

A meeting attended by outage and power-cycle off-shift deputy shift managers is held for each outage in order to draw up a list of power-cycle surveillance tests to be performed during the outage. This list is signed off by the deputy department manager in charge of the outage.

Power-cycle work orders are inserted into the outage schedule. These surveillance tests are full-fledged outage activities.

During the performance phase, the person responsible performing these tests tracks their scheduling and performance on a daily basis.

When the plant is taken into outage, tests are performed whenever necessary, depending on reactor conditions. If the daily analysis shows that conditions required for performing the test have not been fulfilled, the test is left on the schedule. It is the shift manager who makes an on-the-spot decision on whether or not to perform the test, based on reactor conditions.

During restart, tests are scheduled to be performed as early as possible after mode change. During the outage safety committee meeting, tests to be performed in the respective operating ranges are reviewed and approved.

These arrangements were applied during the outages taking place in 2008. No deficiencies were found in the performance of these surveillance tests.

These arrangements are described in procedure PRO 215.

Lastly, a benchmarking exercise focusing on the way in which the plant analyses and trends surveillance test results was performed and submitted to the safety technical committee on 28 March 2008. This study shows that numerous items of data are collected from each craft, enabling test results to be trended. However, the use of this data is not consistent within the various crafts.

Within operations, power-cycle trending arrangements have evolved by emulating those of the outage structure. Within the I&C/electrical maintenance department, a comprehensive system – ranging from data collection to analysis – has been developed. This system will serve as an example for the mechanical maintenance and technical departments.

#### **IAEA comments:**

A comprehensive effort was completed by the plant as part of the EDF-wide project of harmonizing practices and methods. 370 surveillance test procedures were reviewed, checked and validated as a joint effort of the 7 plants operating 900 MW units. Implementation of the revised test procedures was completed in October 2007 at St. Laurent NPP. The periodic revision process of these procedures has already started, also as a coordinated effort of 7 plants. This includes 710 change requests and 377 procedure updates so far.

The different methods of trending and analysing the surveillance test results applied at different organizations of the plant were compared, best practices to be applied consistently throughout the plant have been selected. However, the transition to these unified methods in some organizations is still in the phase of implementation (e.g. Mechanical maintenance department) or being planned (e.g. in the Technical department), awaiting the introduction of new computer applications.

**Conclusion:** satisfactory progress to date

## 6. OPERATING EXPERIENCE

### 6.1. MANAGEMENT, ORGANIZATION AND FUNCTIONS OF THE OPERATING EXPERIENCE PROGRAMME

The Saint Laurent NPP is supported for Operating Experience (REX) by Operations Support Center (CAPE) of the Nuclear Operations Division (DPN) at the EDF Corporate. The CAPE has managed the 19 sites in EDF fleet by providing ten activities in relation to the operational experience feedback.

The plant management considers the REX programme to be an essential part in achieving better operating performance. As a result of management recognition, a comprehensive OE programme is in place. The REX programme is developed in procedures for the management of the internal operating experience, external operating experience, periodical assessment of operating experience activities and programme review.

The GAREX (operating experience coordination group) is an operating experience programme in the plant. The acquired experience in all areas, such as safety, security, radiation protection, environment and competitiveness is well covered by this GAREX.

The operating experience feedback system is managed by GAREX with representatives from each of the departments. They are charged to promote OE activities within each service. This committee plays a key role in both the arrangements for dealing with events on site and the interface with corporate activities. The GAREX coordinates and follows up event based operating experience, and the handling and circulation of outside operating experience sent by the RER (Rapid OE Exchange) and CID (Corporate Inter Departmental Coordination). The GAREX coordinator is the Fleet's contact for operating experience actions supplied by the CID. Each department appoints an operating experience contact, who is a member of the GAREX, responsible for coordinating operating experience actions in his department. The GAREX coordinator is the operating experience process senior supervisor. Duties, responsibilities, authorities and lines of communication within the plant organisation are clearly defined and well understood by plant personnel.

Various tools and resources, such as Internal Engineering Review Meeting in the plant (CID-Eng), GAREX, and Situation Detection Meeting (RDS), etc., are sufficiently provided for the OE programme at the plant. The meeting, however, was held without attendee's signature sheet. The absentee was not checked during the meetings. The team encourages the plant to participate actively and reinforce the operating experience activities.

### 6.2. REPORTING OF OPERATING EXPERIENCE

'A blame free' reporting environment is well established in the plant and communicated to the staff through the plant documentations. All plant staff and contractors are encouraged to report identified events, defects or any other deficiencies. Interviews with various plant staff confirmed that they are well aware of this expectation.

The team recognized that there are several different ways to report identified deficiencies in the field. The plant efficiently uses several EDF corporate databases and applications to report and to handle equipment defects and events. Although the operating experience reporting

practice is based on the requirements stated in a number of diverse directives (e.g. DI-55, DI-60, DI-82, DI-100, DI-103, DI-104, DI-109, etc.), the plant has put a lot of effort into improving its reporting and monitoring tools and reporting environment. These improvements significantly helped to increase the number of identified and reported items.

It was observed that a successful collection system and a good performance for analysis of recurring factors with related action plans are in place. For example, the plant has implemented a detailed organisation with a goal in achieving excellent results related to the requirements stated in corporate DI103 instruction, both in terms of quality and quantity. Due to this analysis of plant recurring factors in 2005 and 2006, the plant is able to draw up the action plans for 2007. The team recognised this as a good performance.

However, the near miss (weak signal) is reported within each department level and tracked by the each department OE coordinators, not by the plant OE supervisor. The team has made a suggestion for better understanding and plant level utilization of near miss to enhance the plant operating experience feedback.

### 6.3. SOURCES OF OPERATING EXPERIENCE

The EDF Corporate has communication channels established with INPO and WANO database and the external OE information was reviewed at the corporation level. The corporate plays a significant role in distributing OE information from various known national and international sources. The corporate group of CAPE distributes this information through the CID sheets to the whole EDF fleet.

The plant has established a process for comprehensive review of incoming external OE information. A regular weekly plant GAREX committee meeting screens and reviews all incoming CID reports at the plant level. In addition, the RER containing quick first level information on important issues from other French plants are discussed. GAREX meetings are conducted in a professional manner. Various aspects are assessed, though mainly the technical aspects of lessons learned and the potential impact to the plant from external events. The responsible departments are assigned for implementation of corrective action, as necessary. Most of the plant personnel have direct access to the CID database via the computer network. The contribution of the plant event reports to the EDF corporate has been significantly improved in the last two year period.

The EDF Corporate Engineering prepares a monthly report which is accessible to all staff on the intranet. The database for International OE is categorized and documented properly. The event of high significance is promptly reported to Senior Supervisor on Safety & Quality. However, an event of high significance (Fosmark) is not known to an instructor who develops the scenario and trains the plant staff. Though the corporate analysis revealed that this event had no relevance to French design, the instructor should have been familiar with it. The team encourages the plant that the source of OE is linked to all learning opportunities and the owner of these opportunities recognize its potential.

### 6.4. SCREENING OF OPERATING EXPERIENCE INFORMATION

The EDF has a network of experts (CAPE/GARADRN) to screen the internal and external OE sources properly. The screening criteria for the significant events are clearly established. The plant contributes to the EDF by informing the 17 event analysis reports and 270

miscellaneous event reports in this year. The EDF management requests every unit to report 2 events per year.

In the case of all events potentially reportable to the national regulatory authority, a very effective tool, a safety forum is used to initiate an investigation process and to inform the regulatory authority in time. An immediate independent assessment of any such event is conducted by a safety engineer and by a shift manager. In case of disagreement of these assessments, clear decision making rules are established.

A six month follow up review process of all significant event reports is established to ensure the quality of reported events and to make sure that the personnel understands the risks involved and its safety consequences. The plant introduced a specific performance indicator to monitor the time limits for the development of significant event report and for informing the regulator.

## 6.5. ANALYSIS

The EDF guideline is used to analyze the selected events depending on the criteria. The criteria are categorized into five fields including human factor, documentation, communication, equipment failure and material conditions. These criteria properly possess the concept of international guideline.

A root cause analysis is performed on all reportable significant events. A specific investigation group is established for each significant event, which requires root cause analysis. All group members have adequate experience and knowledge. At least one group member, typically the safety engineer, has special training in root cause analysis methodology. By EDF directive the fault tree methodology is used to analyze the root causes of all identified significant events.

Very comprehensive event reports including the development of corrective actions are elaborated in each particular case. There is a 2 month time limit to prepare the final report and inform the regulatory authority, which is considered adequate. The specific performance indicator is introduced at the plant to monitor this limit.

The plant has well developed tools for handling technical problems according to their complex technical analyses (engineering opinion sheets in SYGMA database) or equipment and function summary reports. More serious issues are dealt with using in plant projects (SAPHIRE database).

Detailed annual summary reports including summary reviews of significant events, trends and performance indicators are elaborated in a very timely manner. This information is presented to EDF corporate and local regulatory authority representatives.

One human factor specialist is a member of the investigation group, in case any human factor involvement was identified during the event. There is an action plan developed to integrate the human factor analysis into all available OE information in the future.

All events including international events are trended properly according to the EDF guideline and the analysis is performed by the dedicated plant staff with the GTS (Group of technical safety). This dedicated plant staff analyse the events with human factor relevance. As these events are informed by the corporate Human Factor Group, he does not screen the other events in the SAPHIR database. He sends analysis report to the corporate Human Factor

Group to complement or validate this data. This information is kept in a human factor database for internal use by the group. However, the electronic data processing tool is under development in the plant, while a few other plants developed and utilized it to analyse the events. The team encourages the plant to put more effort into improving this area.

#### 6.6. CORRECTIVE ACTIONS

An investigation group in close cooperation with plant departments develops corrective actions to eliminate the root causes of significant events and prevent their reoccurrence. Development of corrective actions is done within the time limit for the final report preparation process. Developed corrective actions are validated and approved at the appropriate plant management levels. The plant well recognises levels of corrective actions used for significant events.

Specific plant departments are assigned for corrective actions implementation. Clear implementation deadlines are set at the plant and regularly monitored closely and tracked via a corporate electronic database. Good timeliness of implementation is achieved. Effectiveness of corrective actions is regularly assessed and monitored.

#### 6.7. USE OF OPERATING EXPERIENCE

By collecting and using adequate OE, the plant has made considerable progress in achieving all outage objectives for 2006, and more specifically in terms of overall outage length, including plant restart, where it has become one of the fleets best performing plants. The team recognized this as a good practice.

Two different types of pre-job briefings are conducted in the plant. One is carried out before an activity with a potential risk of reactor trip, second one for sensitive operating transients. The relevant just-in-time OE information is presented during these pre-job briefings.

The INDEX is the corporate intranet network among all nineteen nuclear sites to share knowledge and good practices in the engineering area and to reach an overall improvement of plant performance. The plant staff are very familiar with it and actively utilized it.

The plant Technical Safety Committee requested the training department to develop an urgent training course for the internal significant event at October 2005 and it was requested to complete the dissemination by the end of 2006. However, the scenario was developed at September 2006. The team encouraged the plant to perform the scenario preparation for simulator training and dissemination of operating experience to plant personnel in a timely manner.

#### 6.8. DATABASE AND TRENDING OF OPERATING EXPERIENCE

Data bases related to events, deficiencies, anomalies, and deviations are established to facilitate an integral view and analysis of operating experience from the point of view of organizational, human factor, equipment failures, work management, and maintenance deviation reports.

For significant events, low level events (minor events), and near misses (non consequential events, potential problems) data base trending system representations (trending parameters) should be established to provide transparent data presentation that facilitate diagnosis of monitored performance, identification of patterns, identification of abnormal trends, identification of recurrences, quick plant management overview and action focus.

Operating experience feedback process is tracked by the electronic data base programs mainly, SAPHIR and SYGMA. These programs are used effectively to analyze significant events, interested events and low level events.

## 6.9. ASSESSMENT AND INDICATORS OF OPERATING EXPERIENCE

Regular self-assessments of the OE program as part of internal reviews of the technical support processes are done once a year. The recent self-assessment results were effectively used to improve the OE program during the plant reorganization and the main achievements of the new organization are considered to be clear structure with better defined responsibilities for all involved groups and individuals. It shows the integration of all units and plant facilities into one compact OE process and is a more effective use of resources.

A wide range of performance indicators are used to monitor the safety performance of the plant. Another set of performance indicators are used to track the effectiveness of the OE programme. The indicators are widely displayed to the plant personnel in various plant areas.

### **SAINT LAURENT NPP FOLLOW-UP SELF ASSESSMENT**

The suggestion in the area of operating experience and more specifically, on how the plant addresses near-miss errors, has been implemented by the plant as part of a corporate initiative designed to deal with low-level events and precursors.

In concrete terms, the plant has enhanced the structure of its management in the field programme. This programme, associated with department monitoring plans, is an effective means of highlighting positive and negative findings. The plant then stores these findings in a database, which identifies basic trends that are used for analytical purposes by the human factors consultant.

Through the direct effect of management presence in the field focusing on professional conduct of activities (an effect previously observed with the management presence programme focusing on plant and material condition), and through resulting trend analyses, the response to low-level events and precursors is a vector of progress in the area of nuclear safety.

### **STATUS AT OSART FOLLOW-UP VISIT**

The plant has made a significant effort to capture near misses and use them as a learning opportunity. In this effort the positive experience of departments which had successful initiatives in the past was used as a basis for developing standard solutions for the entire plant.

The database designed for plant-wide use became operational in June 2008. It allows easy input thanks to its user-friendly nature. The database can be used for trend analysis and identification of areas requiring further management focus or action.

However the programme needs continued efforts to ensure deeper involvement of worker level and more consistent participation of various departments. It is natural that change management across the entire plant organization takes time.

## DETAILED OPERATING EXPERIENCE FINDINGS

### 6.2. REPORTING OF OPERATING EXPERIENCE

**6.2(1) Issue:** The ‘near miss’ concept is not fully understood by the plant staff. An overall plant level analysis of near misses is not implemented.

There is no corporate level or plant level procedure for near miss. The EDF Corporate is considering the generalized implementation of the near miss concept and is starting to fine tune the practical frame work for near misses. The following was observed :

The plant developed the technical memo (note technique 5032) titled ‘Collection of signals and treatment of weak signals (= Signaux Faibles)’ on 14 November, 2006. An experiment based on the principles described in this technical memo was carried out within the I&C Department and an assessment of the experiment was presented to the Safety Strategic Technical Committee held on 9 November, 2006.

- The staff of most departments is not accustomed to the terminology ‘signal faible /near miss’. The analysis results for near misses are not reported to the plant management, even though many examples of near miss treatment were presented within the departments.
- Modification Department developed the department level procedure titled ‘Approach to weak signal (IIS no. 016)’ at 11 Aug. 2005. Two near misses were reported and one near miss added after revising this departmental procedure on 7 September 2006. Up to now, only three near misses were reported. The other departments have not developed a departmental procedure.
- An overall plant level OE activity supervision for the near miss does not exist.
- Mechanical Department & Operations Department received the Technical note No. 5032 recently, and considered it as a no reaction required document.

Without utilizing an overall OE process for near misses, a significant amount of valuable OE information is not captured by the plant and lost for processing, trending and further analysis of generic issues, which can result in barriers not being raised to prevent possible events from happening at the plant.

**Suggestion:** The plant should consider the near miss concept to improve reporting and processing of near-misses as an overall plant level OE programme.

**IAEA Basis:** NS-R-2 and NS-G-2.4

NS-R-2, 2.24 “All plant personnel shall be required to report all events and shall be encouraged to report events on any ‘near misses’ relevant to the safety of the plant”.

NS-G-2.4, 6.64 “Low level events and near misses should be reported and reviewed thoroughly as potential precursors to degraded safety performance”; 6.68 “All plant personnel should be encouraged to report all events and near misses relevant to the safety of the plant.”



### **Plant Response/Action:**

As far as near-miss errors are concerned, the plant has aligned itself with a corporate directive governing low-level events (DI 119). This directive states that “the challenge in identifying low-level events is to take early corrective action prior to deteriorations in performance, by paying more heed to inconsequential findings, near-miss errors and daily occurrences reported by crafts and management”.

We have therefore set ourselves the goal of analysing all reported field observations in order to determine trends. This trend analysis should help us to take action before defects or anomalies occur. This involves identifying precursors in order to determine appropriate corrective actions and expand our store of operating experience.

Actions underway:

- Sustained management presence in the field using monitoring plans drawn up by all departments, and making people accountable for plant and material condition in all plant areas.
- Field observation training for all managers, in order to reinforce the importance of detecting early warning signals. During every field inspection, managers will try to raise 2 to 3 “positive” findings and 2 to 3 “negative” findings.
- The different databases used by the various departments are being replaced by one database so that data can be uniformly processed (“TERRAIN”).
- All field observations are categorized using a certain number of lines of defence. This categorization is used to perform trend analyses in order to identify precursors. This analysis is performed by the departments as well as independently by the human factors consultant.
- Action plans associated with low-level events and precursors will be implemented within the departments and will supplement the Performance Improvement Contract for year Y+1 signed by plant senior management and management of the corporate nuclear operations division. These actions form part of the plant’s
- overall OE programme and are therefore tracked on a regular basis.

### **IAEA comments:**

The plant has made a significant effort to capture near misses and use them as a learning opportunity. In this effort the positive experience of departments which had successful initiatives in the past was used as a basis for developing standard solutions for the entire plant.

The database designed for plant-wide use became operational in June 2008. It allows easy input thanks to its user-friendly nature. The database can be used for trend analysis and identification of areas requiring further management focus or action.

However the programme needs continued efforts in the following aspects:

- at present, the majority of entries are made by managers, only a few items by other staff;

- inconsistent levels of participation by the various departments were observed at the present stage, due to the time needed for coaching the managers in the use of the database;
- the feedback loop of incorporating lessons learned into the plant-wide business plan will be done for the first time in 2009;
- it is natural that change management takes time depending on the size of the organizations involved.

**Conclusion:** Satisfactory progress to date

## 6.7. USE OF OPERATING EXPERIENCE

### 6.7(a) **Good practice:** Operational experience during outages

The integration of local and corporate operating experience obtained in a participatory manner with all field staff has enabled the plant to improve outage performance and has led to a positive trend in plant results.

- After the first outage of the year, the outage structure ‘right at the end of its first outage’ goes over the strengths and difficulties encountered. Improvements which are easy to implement are selected by both plant and department managers, and project participants in order for these benefits to be applied to the forthcoming second outage.
- After the plant’s second outage (the last for the current year), useful items of operating experience is collated within the crafts and classified according to topics. These topics are discussed collectively and a coordinator is designated to address those selected.
- Conference calls between all plants are organized by a corporate entity to inform the whole EDF fleet of experience having occurred on some plants as well as the associated preventive measures.
- The schedule is a common tool shared by all crafts involved in the outage, as data is updated twice a day, thereby providing accurate status of progress being made.
- Good technical or organizational practices are formally written up.
- Collate all items of operational experience by involving all field staff in order to use good practices quickly during outage preparation and performance phases, and in order to rapidly identify courses of action to deal with unplanned situations.
- Prompt rectification of discrepancies identified during previous outages.
- Prior to commencing work, staff are briefed on safety or availability related events having occurred during previous outages, using an OE data base.
- The corporate entity relays events occurring at each plant to the other plants by means of conference calls and documents.
- It also organizes annual forums attended by outage managers in order for them to share their experience.
- The results achieved were, 2001- 5 events, 2002 - 3 events, 2003 –3 events, 2004-1 event, 2005-0 event and 2006-1 event.

By incorporating operating experience into the schedule and by briefing those involved in the outage on the risks associated with their activities, worker attentiveness is enhanced and favourable conditions are created for performing activities.

## 7. RADIATION PROTECTION

### 7.1. ORGANIZATION AND FUNCTIONS

The plant radiation protection programme is established through corporate level procedures which are based on the national regulations. The plant directly implements corporate RP procedures or develops its own procedures based on corporate guidance. Basic RP standards, programs or procedures are prepared at the corporate level in agreement with the regulatory authority.

There are different levels of managerial control of radiological risk, eg: individual dose authorization. The threshold requiring senior management approval is 2 mSv and there have been no exposures to personnel over 10 mSv per year. Moreover, important work planning and dose budgets are discussed at stakeholders committee meetings, made up of trade union representatives and workers representatives together with the plant medical doctor and RP department manager. The same procedure is in use for collective dose evaluation and approval (> 20 man mSv) and dose rate conditions (>40 mSv/h).

Radiation protection goals are defined for the collective dose, for portal monitor contamination alarms. Plant expectation is set so that there should be no spread of contamination outside the RCA. Each department has its own collective dose goal. The goal for individual exposure is set so that no one should receive a dose over 10 mSv in a twelve month period. These goals are respected since the results for 2006 are even below the goals.

The plant also trends other parameters such as: internal contaminations of workers, contamination of clothing, the number of contaminations detected by portal monitors, contamination detected outside the RCA, the number of alarms on truck monitors, any contamination of fuel or radioactive waste transports and any contamination detected on radioactive material shipments.

ALARA performance indicators are established based on work planning and comparison to other power plants of the fleet.

Responsibilities and authorities of the RP management team and RP section supervisors are clearly defined and understood. The RP unit is a part of the Risk Prevention Department (SPR). The plant manager authorizes competent persons in different sections of the RP organization. In case of radioactive source control, reporting is required by regulation directly to the plant manager. Operational RP Supervisors report to the Head of the SPR who reports to the Deputy Plant Manager. The RP sections are well organized and transparently managed. The function of the RP officer is dedicated to the RP section supervisors according to their field of work.

The ALARA program is coordinated by the RP support supervisor who coordinates ALARA planning with other departments. ALARA principles are clearly defined and understood within all levels of the plant organization.

Adequate RP budget and resources are available to the plant based on agreement with the corporate RP Director.

RP personnel are involved in elaboration of operational procedures addressing radiological issues such as setting alarm levels of contamination monitors, checking procedures for portal monitors, ALARA planning procedures and radioactive source control procedures.

In the RP department, there is a comprehensive “presence in the field” programme dedicated to the managers and supported by a software programme. The results can be followed in a transparent way, taking into account all logistic parts of this programme. The RP department carries out more than 200 work observations per year.

RP performance indicators are reported to the plant manager in a timely manner. An overall reporting sheet is presented each week to the plant manager. Radiological events are timely reported and analyzed within the control section of the RP organization. The focus is on the OE of the fleet. Good practices are reported and supported on the plant level.

Programs of good interaction with operations and maintenance groups are in place. ALARA planning is the responsibility of the RP organization but overviewed on a management level for outage and operation activities separately by their respective project managers. The RP issues are discussed at the plant committee regarding high risk work planning. Activities associated with radiological hazards are planned adequately.

The RP department receives questions from other departments to be analyzed by department specialists on a special form. These analyses are available on a computer system to all other users within the plant, about 20 per year.

A dedicated manager is available for supervision of contractors working in the RCA. There are regular meetings during the year, weekly meetings during outages and cooperation through the plant radiological risk (CTRSE) committee. The team considered this a good performance. The subcontractor for RP has its own RP supervisor.

The RP staff is composed of skilled individuals for field and laboratory work. RP supervisors have received a dedicated two years of advanced education/training in RP. Their experience and qualification is appropriate for assigned tasks of plant.

The plant manager is responsible for RP and may decide to request support from different levels of expertise inside or outside the plant due to the availability of the EDF corporate service. He can delegate some of his duties related to managerial aspects of RP to Risk Prevention and Environment Senior Advisor (SA). RP training programmes are relevant to staff duties and responsibilities. A skills mapping system is in place, enabling the transparent management of human resources on a daily basis. The team concluded that this is a good performance.

Since the plant has not defined clear background requirements for the SA, the team encourages the plant to consider defining an advanced training programme for the SA covering topics such as operational RP including source term and radiological aspects of accident management.

The plant medical doctor controls all aspects of individual radiation exposures (external dose, skin dose, internal contamination and internal dose). Effective dose data are recorded in the national dose register and available to the doctor. The medical doctor has access to the official dose register and supervises required radiation monitoring data, including skin dose

assessment and neutron dosimetry. The medical center is responsible for whole body counting and can provide immediate medical attention in case of internal contamination events, help for treatments of injured contaminated workers in hospital; and there is an on-call system for urgent situations.

The plant doctor has additional responsibilities as a research, educational and advisory role, and the team concluded this as a good practice.

RP activities are subject to quality assurance and a quality control programme. This programme is controlled by the plant's safety quality department. The SPR department documentation management and quality control is implemented with the electronic documentation management software used site-wide. Archives are sent to the documentation department which ensures that they are kept safely. The procurement system and test of new equipment is managed by an RP engineer who prepares precise evaluations and reports.

The operational aspects of the RP programme are examined periodically. These checks are carried out both at the technician and manager level. There is a surveillance programme of contractors working for RP, which evaluates the quality of service and compliance with requirements. These results are well analysed at the corporate level.

## 7.2. RADIATION WORK CONTROL

The workplace monitoring programme is well established including surveys, controlling of internal exposures, contamination monitoring and exposure assessments.

Radiation work authorization is established by a radwork permit system. For all activities carried out in controlled or monitored areas, there is computerised dose planning. This is done using software (PREVAIR) which prints out a radwork permit. Initially, the worksite must be created and a dose assessment carried out. The level of radiological risk is classified according to the criteria of collective dose, dose rate and contamination.

Exceptional work permits are drawn up and planning files for high radiation worksites are approved by a committee made up of the RP senior advisor, the occupational health doctor, the department manager and work supervisors concerned by the activity, as well as the person competent in RP.

On the site, the monitored RP areas are delimited. Within the RCA, specially regulated areas are delimited according to radiological conditions (green, yellow, orange and red zones). The different areas are marked sign standardised trefoils. Hot spots are eradicated, marked or identified. Rooms are cleaned in the event of contamination being discovered.

The RCA is divided into four radiological zones as follows: green from 0.0075 mSv/h to 0.025 mSv/h ; yellow from 0.025 mSv/h to 2 mSv/h ; orange from 2 mSv/h to 100 mSv/h (access controlled by SPR); red above 100 mSv/h (access forbidden). The plant has supervised areas outside the RCA buildings.

All information related to access to the rooms is posted on the doors and hot spots are indicated on a table. Hot spots over 2 mSv/h are posted in the field and shielded. The team encouraged the plant to add hot spot locations on the maps and to consider implementing a practical approach of posting of hot spots with a lower dose rate, taking into account ALARA.

The survey of high contamination areas is done by help of laser pointer and RP technician using an audio link to indicate the point to be surveyed to another technician. The team considered this activity of control as a good practice.

Double keys are used for the areas  $> 100$  mSv/h. However, the team suggested to introduce a key control system for the very high dose rates below 100 mSv/h. This will minimize a risk for exposures over dose limits within a short period of time.

### 7.3. CONTROL OF OCCUPATIONAL EXPOSURE

ALARA planning is integrated within the organization and coordinated by the RP unit. ALARA for outage periods is managed separately from unit in service.

Plant specific ALARA guides are developed for the activities required to be planned in a formalized and controlled way. Three criteria are implemented to trigger this planning (dose rate, collective dose and contamination level) and four levels of related radiological risk.

Level 0 means normal procedures (below 0,1 mSv/h or 1 man mSv); Level 1 (up to 2 mSv/h or 10 man mSv) should be optimised by craftsmen; Level 2 (up to 40 mSv/h or 20 man mSv) where optimisation is responsibility of competent RP department; and Level 3 (over 40 mSv/h or 20 man mSv) for which validation of the ALARA planning should be performed on the plant management level and in agreement provided by the stakeholders committee (CTRSE). The risk at the Levels 2 and 3 is very well controlled, which is clearly visible in specific indicators, such as maximum individual dose.

Collective dose of work activities are trended on a daily basis and a complete report on ALARA results, together with other work safety parameters, is provided to plant management weekly. The indicators, goals and results are shared with the staff and contractors at initial meetings and within an ALARA group. In addition, pre-job briefings are held together with the work leader, contractor representatives and plant ALARA and a representative from the relevant plant department. A check list is used to document selection of appropriate ALARA planning tools by the crafts and the projects.

Collective dose achievements are remarkably good for steam generator replacement and recent outages. Comparable to the other 900 MW fleet, and on the broader scale, ALARA results show that the plant has very good performance in this area.

Contamination control measures are implemented according to plant procedures. For high contamination areas, workers use ventilated suits if the airborne contamination is over 0.1 DAC. If this is not practical, then ventilated hoods are worn. Fixed monitoring channels permanently monitor the air. In addition, there is a monthly check of surface contamination in all areas. Air contamination is monitored locally in case surface contamination exceeds a prescribed level.

The regulations on the protection of workers against ionizing radiation require the occupational health services in charge of assessing internal exposure to have accreditation. The laboratory will be one of the first to have ISO 17025 accreditation for its whole body counting unit, in accordance with the European accreditation system and also takes part in benchmarking of results with supervisory bodies. The team concluded that this is a good performance. There are two whole body counters with a required measuring time of one

minute and a detection limit of a few hundred Bq.

In case of an internal dose over 0.5 mSv, a root cause evaluation is implemented. An internal assessment is made by the corporate office based on whole body counter results and, if necessary, a biological sample analysis.

The team encourages the plant to prepare, as a backup, a written procedure with tables and charts for calculation of internal doses due to gamma emitters based on ICRP guidelines.

Appropriate film dosimetry is provided for all radiation workers through contracted accredited services. Neutron dosimetry is based on bubble detectors which are going to be replaced by track detectors. Electronic alarm dosimeters are used in RCA.

#### 7.4. RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING, AND FACILITIES

The hot shop and RP instrumentation shop are very well organized. There is a good selection of portable monitoring equipment. Robust road measuring equipment is also available. The SPR performs daily tests of the portable dose rate detectors by a source check to obtain a minimum response and also fulfill the regulatory requirement for one calibration per year. There is a surveillance test procedure in place for a subsequent precise calibration check on a monthly basis. The team encouraged to record in one tabulated form a prescribed minimum number of operable detectors together with their measurement range and calibration check results.

Individual dose monitoring equipment is adequate.

Monitoring channels provide adequate control of effluent release paths. Equipment is properly calibrated by a contracted accredited organization and periodic surveillance tests are performed. Unmonitored effluent pathways such as turbine building effluents are controlled by sampling.

For environmental monitoring there is good equipment available with appropriate QA controls in place. The plant also has adequate instrumentation and facilities for emergency situations. There is an adequate inventory of protective clothing (PC) and respiratory equipment and the quality and adequacy of supplies such as shielding, signs, ropes and stands is appropriate.

The team concluded that the exit from RCA, laundry facility and the dedicated clean equipment and truck monitoring areas is a good performance. There is an additional exit from RCA to be used for outages, fully equipped with portal monitors. Boxes for placing electronic dosimeters and segregation of clothes at the exit from RCA is done well.

The temporary storage of radwaste, contaminated materials, equipment and tools is provided and easily accessible. Appropriate decontamination facilities are available and well maintained. Access and exit facilities related to the RCA are organized in way to prevent transfer of contamination by workers. The same is achieved for controlling the free release of tools and equipment pieces. The RP monitoring equipment installed at the exit from RCA is of a very high standard. Laundry, storage and shower facilities are well maintained.



Radioactive source inventory is controlled by means of a new software and the team considered this as a good practice.

## 7.5. RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

The management of radioactive waste complies to French regulations, based on the principle of precaution: any waste from a controlled area is automatically considered as potentially radioactive. The waste control program at the plant is based on origin or room classification.

Storage and packaging of radioactive waste results in minimizing exposures. Workers are knowledgeable on handling radwaste.

Classification of radioactive waste complies to the requirements of outside radwaste processing and storage services. At present, France has 3 systems for the disposal of radioactive waste:

- ANDRA FMA (low or medium level waste) for concrete packages and metal drums
- CENTRACO since 1999 (low or medium level waste destined for incineration or fusion)
- ANDRA CSTFA since 2004 (very low level waste: blow down resins < 100 Bq/g, gravel < 10 Bq/g for example).

The radwaste optimization programme allows the very low level radwaste to be sent to ANDRA CSTFA. Waste from a controlled area can be processed as conventional waste if a dossier justifying this is drawn up by EDF and approved by the safety authority.

In the future, the plant will make progress in sending out or release certain “nuclear” waste into the conventional disposal systems by declassification of some rooms and possible applications for authorizations from the Regulator for free release of conventional waste . The team encouraged the plant to apply a systematic approach in identifying un-contaminated waste streams to reduce amount of radioactive waste.

Releases are kept within authorized limits. Goals and objectives are implemented based on ALARA standards.

A well established environment monitoring and reporting programme is in place. Methods have been established for calculation of doses for critical groups and to the general population. The plant is accredited for environmental management based on the standard ISO 14001. There is a plan for accreditation of the plant environmental monitoring lab located 10 km from the plant. Independent surveillance is provided by outside technical organizations. The results of RP monitoring are trended.

## 7.6. RADIATION PROTECTION SUPPORT DURING EMERGENCIES

An offsite emergency evacuation facility is available 10 km from the plant in the same building as the environmental lab. Two mobile units (vans) are available with full equipment necessary and trained staff on-call for environmental monitoring and sampling.

Each member of the RP department receives initial emergency training. Emergency exercises are carried out every year and each member of staff takes part in them. For 2006, there have been eight emergency exercises, enabling each member of staff to take part at least one exercise. Critiques of drills and exercises provide corrective improvements into the program.

However, the team has recognized that there is a need for additional retraining for on-site actions necessary to be implemented in case of post accident sampling, and suggested periodic retraining of RP technicians.

### **SAINT LAURENT NPP FOLLOW-UP SELF ASSESSMENT**

The two OSART suggestions in the area of radiation protection have been addressed.

Their implementation has consisted of two basic corrective actions: installation of physical devices for barring access to two particularly high-dose rooms, and the provision of specific training for technicians involved in the EPP.

In addition, the encouragements issued by the OSART team have been addressed. These focused on the location of hot spots (promptly dealt with in December 2006, by placing coloured markers on the maps at room entrances and by incorporating this point into risk prevention procedures), the redundant procedure for calculating internal dose (monitored by the medical department), tracking of the risk prevention department's measuring instruments, and waste reduction (French policy, via the contamination control initiative).

Each of these actions constitutes a step forward in terms of nuclear safety.

### **STATUS AT OSART FOLLOW-UP VISIT**

Further to setting a dose rate threshold of 10 mSv/h, a total of four rooms in the Radiation Controlled Area of both units have been locked with a padlock by the radiation protection department. The major advantage of limiting physical access to these rooms is to prevent inadvertent access and to eliminate risks of unnecessary radiation exposure. As a 'side effect', the dose saving from not having to perform monthly radiation surveys in these rooms is estimated at around 10 mSv annually.

The training sessions on radiation protection aspects of post accident sampling covered preparations for the taking of liquid and gaseous phase samples. Based on certain assumptions of elevated dose rate levels, radiation doses for the taking, transporting and analysing of samples were calculated. The training included a walk down of the respective sampling points and transportation routes in the field and calculation of doses associated with these actions. The training involved all on call staff members who could be requested to perform this task.

## DETAILED RADIATION PROTECTION FINDINGS

### 7.1 ORGANIZATION AND FUNCTIONS

**7.1(a) Good practice:** The plant doctor has additional responsibilities as a research, educational and advisory role. He is involved in studies regarding body stress conditions, for example, due to ventilated suits. Based on these studies, he gives advice at the national level. He is also a member of the stakeholders committee regarding high risk work planning and contributes to work safety.

The doctor carries out risk mapping for each post and for each employee. He also takes part in debriefings after incident situations. He participates in annual colloquiums at national and international level and is a member of a steering committee of national professionals in this field. The doctor prepares educative courses for medical personnel in the region who do not directly deal with radiological incidents. The doctor represents the plant to the public and local community to explain the medical aspects of injuries or exposures of personnel in case of radiological incidents.

Beyond normal health care, the plant medical center has developed preparedness – including equipment, personnel, procedures and training & drills to handle up to 50 patients with radioactive contamination.

## 7.2. RADIATION WORK CONTROL

**7.2(1) Issue:** Only the minimum requirement of a special decree is implemented for the RCA to prevent access to the areas with a dose rate equal to 100 mSv/h or above.

- Access to very high radiation areas is not prevented by a key control procedure if the dose rate is below 100 mSv/h.
- There is only one room where there is a possibility that workers may receive a dose over the plant dose constraint (16 mSv per year) within a short time and this room can be easily locked
- A possibility exists that the dosimeter alarm is not heard or the dosimeter may be out of order in high radiation areas having lower administrative control priority.

Without preventing access to areas where there is a potential vulnerability of workers receiving higher than normal doses, full ALARA principles may not be complied with.

**Suggestion:** The plant should consider implementing a physical barrier preventing access to very high radiation areas with a limit value below 100 mSv/h.

**IAEA Basis:** The Safety Guide on RP NS-G-2.7 (par. 3.6) requires that “some zones will necessitate setting conditions for restricted entry and special entry.”

### **Plant Response/Action:**

St Laurent NPP has reviewed those areas in which dose rate potentially ranges from 10 to 100 mSv/h.

On the basis of this criterion, two areas have been identified during normal plant operations: The area located around the reactor cavity and spent fuel pit cooling and treatment filter 1PTRP011FI (located in room 1K216, under room 1K214), and room 9ND338 (fanning of unit-2 pipes).

These two rooms have now been equipped with locking devices to control access.

#### 1) Area inside room 1K216 :

In order to access the area around filter 1PTRP011FI, it is necessary to step through the shield set up around the reactor cavity and spent fuel pit cooling and treatment pumps (room 1K216). Furthermore, an additional locking system managed by the risk prevention department has been installed to strengthen this barrier.

#### 2) Room 9ND338:

Room 9ND338 is kept closed by a series of 3 doors. These 3 doors are locked using a padlock system managed by the risk prevention department.

**IAEA comments:**

Further to setting a dose rate threshold of 10 mSv/h, a total of four rooms in the Radiation Controlled Area of both units have been locked with a padlock belonging to the radiation protection department. This limit value was set based on an analysis taking into account several factors. The major advantage of limiting physical access to these rooms is to prevent inadvertent access and to eliminate risks of unnecessary radiation exposure. As a 'side effect', the dose saving from not having to perform monthly radiation surveys in these rooms is estimated at around 10 mSv annually. A draft procedure has been prepared to formally include this initiative in the plant's radiation protection practices.

**Conclusion:** issue resolved

- 7.2(a) Good practice:** A laser pointer is used in carrying out radiation and contamination surveys in application of the ALARA principle of optimization of individual radiation exposure. A technician with an audio link indicates the points to be surveyed to another technician doing the survey in a hostile environment such as reactor cavity. Dose saving is reported to be about 30 %.

#### 7.4. RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING AND FACILITIES

**7.4(a) Good practice:** Management of radioactive source control was improved by implementation of new software.

The management has delegated to a competent person appointed by the plant manager. His qualifications are defined by the regulations. He has access to the software tool MANON which is a unified programme accessible to all EDF nuclear plants, as well as to the regulator. In this way he monitors the inventory, activity and movements of all sealed and non-sealed radioactive sources, including spare parts containing radioactive sources. The software automatically generates alerts for overruns of activity, dates for leak tightness or inventory checks, etc.

The competent person coordinates a network of responsible persons in the different departments related to control of local storage areas.

Several types of check are done on radioactive sources: radiation protection checks at the arrival or departure of a radioactive source, annual technical checks, periodic checks carried out by those responsible for managing rooms, monthly surveys of rooms and storage safes, annual regulatory checks of storage room protection equipment. A binder with photos of sources has been compiled.

Sources are carried in special cases marked with a trefoil. At the acquisition of a radioactive source, the analysis of the need is traced in a standard form and approved by the holder of the authorization or a delegated person. Sources entering or leaving the site as well as movements on site are tracked on specific forms.

## 7.6. RADIATION PROTECTION SUPPORT DURING EMERGENCIES

**7.6(1) Issue:** RP technicians take part in emergency exercises but they are not specifically retrained for accident situations and the plant does not have easily retrievable information regarding radiological risk at the site.

- RP technicians are not familiar with post-accident sampling, which is done partly by a special corporate team and partly by plant staff. However, the RP organization of the plant has the responsibility to provide radiation protection support to those who take samples.
- Practical training on taking samples and transporting them in shielding container for analysis has not been done. Post accident sampling of the containment atmosphere or reactor coolant water may involve high dose rates and stressful situations.
- Risk assessment for the RP team who may assist in taking the samples at the plant or perform other actions in case of an emergency is planned to be prepared just before the sampling.
- The plant has no pre-calculated values available at the site regarding radiological risk at the exposed locations which may be visited during an emergency.

Without adequately trained RP personnel for post accident sampling and availability of radiological risk studies, the plant may not be adequately prepared for this work to be performed in the minimum possible time, and may not be familiar with overall actions to be taken.

**Suggestion:** The plant should consider preparing the necessary information regarding radiological risk at the locations which could be visited during an emergency, and retraining RP technicians for such situations at the plant.

### **IAEA Basis :**Safety Guide NSG 2.7

Para 5.4 “Training for workers should cover all topics relevant to the radiation task assignments and the potential risks. Those who need to work in zones of high radiation levels should be trained in their specific work activities so as to enable them to perform their duties in the minimum possible time, in keeping with the principle of optimisation. This could include, for example, training on mock-ups, rehearsing the planned work and practising emergency actions.”

Para 5.7 “Training on emergency procedures should be given periodically to ensure that all persons who would need to take action in an emergency know which actions to take.”

**Plant Response/Action:**

St Laurent NPP has introduced a training course entitled “radiation protection in post-accident conditions” (code 117M).

This course enables workers to:

- Deal with potential risks incurred while performing actions in areas they are liable to go to in emergency situations,
- Have technicians at their disposal who are able to perform risk assessments for emergency work having to be performed in post-accident conditions,
- Forecast dose associated with these activities,
- Identify liquid and gaseous sampling points in abnormal conditions.

The course is described in the set of specifications referenced SE/RP/07-09/CDC117M.

Two training sessions took place on the 21/22 April and 28/29 April 2008. They were attended by 11 members of staff representing the PCM 3.1 on-call position (risk prevention specialist, RP specialist) and the PCM 3.2 on-call position (1<sup>st</sup> assistant). These arrangements ensure that there are competent people on site at all times.

Skills are maintained by providing the relevant staff with refresher training.

This training course, as well as refresher training sessions, is included in the training & qualification plan for industrial safety and RP staff (procedure ref. NT4536).

**IAEA comments:**

The training sessions on radiation protection aspects of post accident sampling covered preparations for the taking of liquid and gaseous phase samples. Based on certain assumptions of elevated dose rate levels, radiation doses for the taking, transporting and analysing of samples were calculated. The training included a walk down of the respective sampling points and transportation routes in the field to check whether the conditions and limitations of the risk analysis would allow for actual task performance.

The training involved all 11 on call staff members who could be requested to perform this task should the need for post accident sampling arise. Periodic retraining on this subject will be performed in the future. The corporate requirement for the frequency of retraining is once every 4 years, while the plant commitment is once every 3 years.

**Conclusion:** issue resolved



## 8. CHEMISTRY

### 8.1. ORGANIZATION AND FUNCTIONS

The chemistry section is part of the technical department, which works under the authority of the department manager. The department manager is assisted by a chemistry engineer who gives technical support.

The Technical Department is well organized into four parts: plant unit laboratory, environmental plant laboratory, testing section and support services. The laboratories are coordinated by chemists who manage the laboratories; they are responsible for coordinating the work of the chemists in the laboratories and report to the department head. There is no specific head of the chemistry department; the responsibilities for the technical part are shared by the front line managers and the chemistry engineer. The management responsibilities are performed by the front line managers.

There are sufficient chemistry workers and chemistry foremen to guarantee good chemistry surveillance. A job rotation takes place regularly to guarantee the spread of knowledge across the whole team.

The goals of the plant chemistry section and the job description are given to the chemistry staff at each stage of development up to the chemistry front line manager. This is discussed annually between the staff and their line manager and signed by both parties. An assessment of the past goals is done and is always presented visually in charts on the walls of the laboratories. A progress chart is also used to keep all personnel informed.

Continuous assessment and self assessment take place in form of external and internal audits. The results are documented and the necessary corrections are initiated.

The specifications for the chemistry section are issued by CEIDRE which is responsible for the compatibility of the hardware with the chemistry section.

There is a close relationship between CEIDRE and other EDF organizations (SEPTEN, R&D, CIPN CNEPE, GPRE, UNIPE and GPSI). Chemistry staff members take part in an annual meeting with colleagues from other plants in France. They share their experience not only through presentations but also via personal contact. They also participate at other regular meetings dealing with technical or managerial issues.

The chemistry section is consulted when chemical problems appear. Liquid waste management is performed by the shift team which contacts the chemistry section in case of queries regarding chemical problems like identifying dangerous combinations of waste. The team encourages this way of working.

The data are recorded in the MERLIN System which is provided by CEIDRE. Any deviation of values according to the limit values will be indicated by this system. An extra visual system for early trend recognition is implemented. However, the user has to create these trending curves manually. Trending curves are prepared monthly and on demand by trained staff: all the chemists completed a three day training programme, the head of the shift team and the

shift team operators who received three hours of training and the nuclear safety engineers who received a half-day training programme.

There is good communication between the shift teams and the chemists. Every morning the laboratory front line manager and the shift manager meet in the shift manager's office for a short briefing. Before attending this meeting, the Laboratory Front Line Manager collects nuclear safety information in the control room. The information exchanged between the front line manager with the shift manager will be given to the chemistry foremen and technicians via a short briefing. The day's work will also be discussed. There is a procedure like a check list for informing the team: "Le MRE prend la parole" (the Team Operations Manager is given the floor), so that nothing important will be lost. The briefing is always conducted in the same way each time; that is to say, the front line manager collects information from the control room while the technicians do their preparation for the meeting in relation to important nuclear safety issues. The reverse, that is, the information flow from the technicians to the manager will be done after lunch, again in a short briefing. Each technician will be interviewed by the front line manager. Everybody has to give a short report about their work and any special issues. The team considers this way of briefing as a good performance.

The chemists are trained on the job, the experienced technician teaches the younger/newer colleagues on how to do their work. This is also a part of the rotation system in chemistry. For each member of the chemistry section an individual training plan is developed according to the training procedure and personal development is documented in the annual appraisal.

Detailed written procedures as well as the necessary equipment are available. Procedures issued from CEIDRE are adapted by the foremen or the technicians to the individual purposes of the laboratories and the procedures are rewritten according to the skills level of the users. Certain written instructions explain the procedures on a step-by-step basis and are backed up by pictures for ease of reference and understanding. The team recognises this unique procedure as a good performance to ensure correct understanding of procedures and instructions.

## 8.2. CHEMISTRY CONTROL IN PLANT SYSTEMS

The overall chemistry program created by CEIDRE is added to using local specifications by a highly skilled technician and checked by a front line manager. The individual standards are implemented by clear procedures. Adequate performance indicators are given in the form of specifications in the "Chemistry handbook" written by the chemistry support engineer. The source of the "Chemistry handbook" are the EDF chemistry guidelines written by CEIDRE. The chemistry control program is reduced to the minimum but sufficient to detect any deficiencies in water chemistry. However, there are no instructions nor instruments for detecting anything more than the necessary.

Checking fuel, oil, and lubricants belongs to the maintenance department. Hydraulic oil is also checked by the Maintenance department. They take the samples and send them to the independent contractor laboratory. This procedure is a proven practice in France.

A continuous, instrument-based measurement of Boron is performed. The chemistry section makes a manual cross-check of the boron concentration once a week. Lithium is measured

daily whereas the important anions and sodium are done once a week. Other elements such as calcium, magnesium and also silica dioxide are measured on an occasional basis.

No condensate polishing circuits exist in the secondary side. There are some leakages in the condenser. The sodium values seen without leaks are all within the expected area. Because of the leaks, the sodium values lead to a deteriorated mode during the process in the tolerated area and the limit values for sodium in the blow down water are often exceeded. The results are entered in MERLIN, any non-compliance of the limit values are clearly shown by diagrams. The chemistry section takes the necessary corrective actions to minimize the sodium concentration in the secondary side. However, due to the frequent changes of power in unit 2, a good, sustained sodium chemistry is not possible. An exchange of the condenser is planned in the coming years.

### 8.3. CHEMICAL SURVEILLANCE PROGRAMME

Procedures, schedules and analysis methods are checked on a three month basis by the front line managers and technicians, and also annually. There is a multi-checking procedure to prevent mistakes and errors. The procedure will be written by a Front Line Manager or technician, for example, then checked by the Front Line Manager or higher grade. Either the Front Line Manager or higher grade staff member can ask the original author to make any modifications. Finally, it is approved by the Methods Front Line Manager or Head of Department. The document is only valid if it is signed by all three people and also accepted by the Documentation Department of the plant.

The calibration of the instruments is done well, on a regular basis and at fixed intervals according to the necessity of the instruments, and is afterwards documented. The maintenance of the instruments takes place annually and is documented.

Appropriate chemical and radiochemical standards are used and are regularly checked and exchanged. The results of the calibration of all the analyzing instruments with the standards are documented and also monitored in safety cards. The results are also shown by trending curves. This practice is very well performed.

The environmental laboratory has strong quality management and quality assurance programmes because it is on the way to becoming accredited, but the chemistry programme of the conventional laboratory is not complete. The team has made a suggestion for the chemistry section staff to resume participation in benchmarking for conventional chemicals (non radio active chemicals measured by chemical methods).

Procedures to control effluent releases are in place and working well. Effluent release records are adequately maintained. Liquid effluent controls are recognized by the team as a good practice.

All the results from chemistry are put in the MERLIN database. The chemistry section staff, each department head, the shift personnel and other workers have access to this database. MERLIN contains the information of all plants in France. It is possible to create trending curves. MERLIN also monitors the values, so that no limit values are ignored.

#### 8.4. CHEMISTRY OPERATIONAL HISTORY

The documentation tool is MERLIN and even though the trending curves are infrequently used, it is used by certain people such as the chemistry engineer, the foremen and the technicians. MERLIN is not always simple to use, so there is a barrier to use this helpful tool.

Merlin allows for deviations linked to chemistry to be detected by printing “Le Journal Des Ecarts” (Deviations Log Book) on a daily basis, this is compulsory for finalising results. Once they have been validated, the results can be accessed by non-Chemistry staff; for example, the shift team. The analysis of “Le Journal Des Ecarts” leads to the declaration of deviations in the appropriate software (SYGMA and SAPHIR). The Technical Department annually draws up a report on the deviations declared throughout the year.

The curves of the main parameters are created using MERLIN and displayed on a notice board. This board is the support system for performing an analysis of these parameter trends which are widely distributed.

It is possible to obtain trending curves for the last five years, but to get data going back further than five years, the support of CEIDRE is needed.

#### 8.5. LABORATORIES, EQUIPMENT AND INSTRUMENTS

All the laboratories of the chemistry section are sufficiently equipped with all the instruments the chemists need to do their job. There is nothing more in the laboratories than is necessary. New instruments will only be bought when old instruments will not longer work or there are no longer replacement parts available. For example, the last maintenance of the Varian instrument was done on 12 January 2005. An annual maintenance was usually done. It was reported that no more maintenance will be done because the contractor is not able to do this anymore due to of the age of this instrument. This instrument will be exchanged in the coming years.

The chemicals in the chemistry section are usually well-labelled, stored and handled. However, the labelling, storage, handling and calibration of a few chemicals used in the laboratories is not always done in an accurate way. The team has made a suggestion concerning the correct labelling of vessels containing chemicals and the responsible handling of hazardous chemicals.

A unique system has been implemented by the plant called the “Passe-Plat” (Sample Hatch). Using this system, samples from the RCA in the hot laboratory pass through a hatch where they are stored in a sealed container which will transport them to the laboratory. The team recognizes this Sample Hatch system as a good practice.

There is a quality control system implemented by CEIDRE and UTO called “PMUC” (products and equipment to be used at nuclear plants). About 60% of all products which will be used in the plant are according to PMUC. The system is that, by using PMUC, the supplier will be an approved one and has permission to deliver the plants with approved and checked goods. A check by the chemistry section is not specified but CEIDRE carries out random checks.

## **SAINT LAURENT NPP FOLLOW-UP SELF ASSESSMENT**

The two suggestions in the area of chemistry have been addressed.

The first has been addressed by implementing a cross-comparison test, while the second has been addressed by incorporating the labelling requirement into plant reference standards established within the scope of the site-wide risk prevention initiative (R.1.5) and the plant monitoring plan.

Given the accuracy of measurements provided by the cross-comparison test, combined with reinforced labelling requirements, both these points constitute a step forward in terms of nuclear safety.

### **STATUS AT OSART FOLLOW-UP VISIT**

In 2007 and 2008, the plant participated in two recent laboratory benchmarking exercises to compare 'conventional' chemistry parameter measurements. Laboratory work practices were changed and new laboratory equipment was purchased after the first exercise in order to improve the accuracy of certain measurements. As a result, the 'compatibility' ratio of the plant's measurement results improved significantly.

The plant took two types of action to improve the handling and labelling of chemicals: providing specific training on the subject and improved monitoring of performance in the field. Stronger management oversight has brought about visible improvements in several chemical storage areas and the central maintenance workshop. However, in other chemical storages and in the 'hot' maintenance workshop several unmarked or improperly marked containers and chemicals which have exceeded their validity period are still present.

## DETAILED CHEMISTRY FINDINGS

### 8.3. CHEMICAL SURVEILLANCE PROGRAMME

**8.3(1) Issue:** Independent assessment for conventional chemical analysis has not been fully completed.

The hot laboratory and the environmental laboratory take part in an annual benchmarking for activity quality assurance with good results. However, benchmarking for conventional chemicals like sodium, lithium, boron, chloride, sulphate, ammonia or hydrazine used in the secondary and primary circuits have not been performed since 2002. Before that, CEIDRE used to carry out benchmarking for the analysis of these parameters. After 2002 there has been no quality assurance carried out in relation to the benchmarking of conventional chemicals.

The team found that no conventional benchmarking is performed since 2002. To assure the quality of the conventional chemistry analyses, it is essential to check results by independent benchmarking. This independent benchmarking will also show any weaknesses in the chemistry analysis procedures.

Without a complete analysis assurance program, including benchmarking activities, incorrect analysis may result that could affect the integrity of the plant equipment.

**Suggestion:** Consideration should be given by the plant to participate in benchmarking for conventional chemicals.

An example of such benchmarking is that more than 50 different power plant laboratories in Europe participate in the proficiency test of the University of Barcelona for nuclear power plant chemistry.

**IAEA Basis:** 50-SG-Q 13. 403. "Chemistry and radiochemistry work normally consists of - Controlling of laboratory conditions, practices, equipment and materials to ensure the accuracy of analytical results."

#### **Plant Response/Action:**

In 2007, St Laurent NPP signed up for the cross-comparison tests offered by IQS (Barcelona University in Spain). Results were analysed in order to set about improving analysis methods used by the chemistry section. This analysis has been formally documented in a record referenced D5160-SD-ENR-08/0365.

In 2008, the proposed initial changes were implemented when taking measurements as part of the test performed in March 2008. Results were immediately analysed in order to corroborate or invalidate the appropriateness of actions taken in order for these to be embedded in our practices over the long term.

**IAEA comments:**

In 2007 and 2008, the plant participated in two recent laboratory benchmarking exercises to compare 'conventional' chemistry parameter measurements. Laboratory work practices were changed and new laboratory equipment was purchased after the first exercise in order to improve the accuracy of certain measurements. As a result, the 'compatibility' ratio of the plant's measurement results improved from 55 % in 2007 to 73 % in 2008. Initially, the plant plans to participate twice a year. Once results improve, participation will subsequently be reduced to once a year.

**Conclusion:** issue resolved

- 8.3(a) Good practice:** There is an applied management system to project liquid RW effluent releases together with close monitoring of effluent production in nuclear areas. The effluent control laboratory has on-line river flow data available, as well as analysis results in electronic form to be able to project concentrations in the river. As soon as the flow rate of the Loire falls below  $60\text{m}^3/\text{s}$ , the site of Saint Laurent takes charge of the coordination of tritium releases from the tanks of the four NPP sites located over a distance of about 200 km along the Loire, that is altogether 18 liquid radwaste monitoring and discharge system tanks. Saint Laurent collects the relevant information from the other sites and draws up an overall weekly schedule for releases to come, taking account of transit time. This schedule is submitted to the other sites for approval, then sent to the regulator, every week. The sensitive environment of a natural Loire reserve remains protected respecting regulatory limit for the concentration.

## 8.5. LABORATORIES, EQUIPMENT AND INSTRUMENTS

**8.5(1) Issue:** Chemicals are not always correctly labelled and checked according to the existing procedures. Management field presence is not sufficient to ensure that industrial safety rules and practices concerning handling of chemicals are followed.

- Warning symbols and a contents list on the closed sampling waste container in the chemical storage room are missing.
- In one plastic box in the chemical storage room, there was no separation of flammable, acidic, and caustic waste.
- Old, out-of-date chemicals in the chemical storage room were found
- In the chemical storage room, there are excellent safety cupboards used but no official maintenance is carried out. However, an annual visual check is performed.
- Outside, in the large container storage area, an unlabelled container containing unknown chemicals was found.
- In the same area, another container containing unknown chemicals with old, torn and illegible labelling was also found.
- A plastic cup filled with what looked like grease, maybe Vaseline or similar product, was not labelled in the workshop area.
- A bottle with oily fluid was found unlabelled in a cupboard in the workshop area. This liquid could be flammable.
- In the workshop, there was an unlabelled spray can filled with an unknown, clear liquid which could be water. This was found twice in two different areas of the workshop.
- In the same workshop, some cooling lubricant for drill machines was found in an unlabelled tin. This lubricant could be an irritant.

Unlabelled chemical products could be dangerous as users might not be familiar with containers and their contents if they do not always use them. Lack of labelling, or mislabelling, could lead to mishandling, injury, damage or hazards.

**Suggestion:** The plant should consider enhancing its effectiveness in training and management field presence to ensure proper labelling and handling of any chemical products in order to protect people from hazards or injury.

**IAEA Basis:** NS-G-2-4:

6.56. “An industrial safety program should be established and implemented to ensure that all risks to personnel involved in plant activities, in particular, those activities that are safety related, are kept ALARA. An industrial safety program should be established for all personnel, suppliers and visitors, and should refer to the industrial safety rules and practices that are to be adopted”.



### **Plant Response/Action:**

Further to a framework letter issued by the senior advisor for environmental risk prevention, the systematic checking of labels in the various rooms and workshops has been incorporated into department management contracts. The exhaustive labelling of chemicals forms an integral part of standards that are checked during industrial safety field inspections, housekeeping inspections and department monitoring inspections, etc. Furthermore, the risk prevention department has provided all staff with training focusing specifically on the use of hazardous substances and on the use of CMR substances in particular.

Progress is monitored on the occasion of periodic interviews held between department managers and the associate director, where the achievement of department contract objectives is discussed.

A monitoring plan has been drawn up and checks are performed by the strategic coordinator (senior advisor for environmental risk prevention), accompanied by the operational coordinator (deputy chemical/environmental engineer from the technical department) and by a member of management from the respective department. The latest check shows that departments have improved their response to risks associated with hazardous chemicals (example: 26/06/2008 – I&C/electrical maintenance and mechanical maintenance departments).

### **IAEA comments:**

The plant took two types of action to improve the handling and labelling of chemicals: providing specific training on the subject and improved monitoring of performance in the field.

A framework letter was issued in 2007 setting new focus areas for the business plans of various departments. It calls for the handling and labelling of chemicals in workshops and laboratories to be routinely checked, but does not explicitly address storage areas.

Stronger management oversight has brought about improvements. However, the “Terrain” database developed for addressing findings from field observations and near misses does not specifically include a category for capturing chemical labelling issues. This aspect is addressed in the industrial safety assessment form.

The tour of several chemical storage areas and the central maintenance workshop did not reveal any deficiencies in the handling and labelling of chemicals.

However, in the outdoor chemical storage several deficiencies are still present:

- 8 pieces of 20 kg containers of P3-Ferros 5260 have exceeded their validity period;
- about 150 l of P3-Ferrolin 6211 in a 900 kg container have an expired “best before” date;
- a 30 l container has no label and no other indication of content;
- a 30 l container has no label but a handwritten mark “Elimark”;

- a 220 l container has no label but a handwritten mark “Deconta N”.

In the ‘hot’ maintenance workshop inside the radiation controlled area, there are further deficiencies:

- a 5 l container has no label but a handwritten mark “Fixature”;
- a 2 l spray container has no label and no other indication of the content;
- an 1 l plastic container with black substance has no label and no other indication of content;
- an 0,5 l plastic container with transparent liquid has no label and no other indication of content.

**Conclusion:** satisfactory progress to date

**8.5(a) Good practice:** Using the sample hatch system to transport samples out of the nuclear auxiliary building from one radio-chemical laboratory inside to the other which is outside the RCA.

The sampling system of the radioactive samples is located in the nuclear auxiliary building. The analysis of the samples takes place in the radiochemical laboratory outside of the auxiliary building. What is usually found in other French NPPs, is that the person taking the sample had to leave the auxiliary building using the necessary exiting requirements (removing protective clothing etc) and leaving the RCA.

Using a sample hatch to get samples out of the nuclear auxiliary building: Samples from the radiological controlled area for analysis in the hot laboratory pass through a hatch. They are stored in a sealed container which will serve to transport them from the hatch to the laboratory.

- the laboratory works in line with the requirements of the corporate DI82 guidelines while ensuring sample integrity
- samples are secured in the container and placed in the hatch while waiting to be taken to the hot laboratory
- time saving in case of quick analysis (some samples must be analysed precisely one hour after sampling).
- hatch and container contamination is checked on a monthly basis

The laboratory no longer depends on a contractor to get the samples out. During shutdown phases when sample flow is very high (up to one sampling every thirty minutes) a person no longer needs to wait at the exit door of the RCA.

## 9. EMERGENCY PLANNING AND PREPAREDNESS

### 9.1. EMERGENCY PROGRAMME

EDF operates nuclear power plants (NPP) in 19 locations in France with similar type of PWRs. The similar features provide the advantage of common planning and sharing of experience and is supported by a company policy to rotate management level personnel between sites and headquarters. The general structure of emergency classification, organization and facilities is to a large extent similar. The company provides the NPPs with effective support organizations with their equipment in Paris headquarters and elsewhere, like technical support from Chinon. The company also provides the site also with emergency plan implementing procedures and computer applications relevant to French PWRs. However, in the site specific application each NPP is independent.

The French EPP for nuclear power plants has four corner stones: NPP, EDF/national, national authorities and local authorities. In each of these activities are conducted on four spheres: operational, decision making, expert support and communication.

The emergency plan has traditionally used three classes:

- Personnel or otherwise conventional emergency
- On-site radiological emergency
- Off-site emergency

Administratively France is divided into 95 departments. The off-site emergency planning belongs to the responsibility of each department. The prefect of the department in which the NPP is located has a coordinative role with other departments and national, regional and local authorities.

Saint Laurent NPP has delegated the responsibility of on-site emergency planning and preparedness (EPP) effectively in the line organization. The EPP engineer in the safety and quality department coordinates the site crisis management planning with the support of the EPP committee. This committee is made up of six members, with the safety and quality manager as chairman. It evaluates continuously EPP. This planning is delegated to line managers through the Nuclear Technical Committee (CTS) which approves the EPP arrangements and PUI plan. The safety and quality manager has changed for a few months ago and also the EPP engineer is going to move to another plant and a successor has been nominated. These new responsibility holders have a challenge to maintain the high level of EPP activities.

Emergency plan and emergency plan implementing procedures have been written by the EPP committee, reviewed by the EPP engineer and approved by the safety and quality manager according to systematic plant procedures. Plant line managers have allocated adequate resources and authority to EPP and the individuals on the on-call list demonstrated their commitment to their EPP activities as belonging to their job position.

### 9.2. RESPONSE FUNCTIONS

Generally, each organizational unit carries the responsibility of creating and updating its emergency plan implementing procedures with the support from EDF corporate level in co-

ordination by the EPP engineer. The consistency of these procedures has been tested in regular co-operation exercises in which the participants are rotated to share the experience.

Post Accident Sampling System (PASS) enables sampling from containment water and air but not reactor coolant; the sampling from containment air can be done by the plant personnel while the samplers of containment water come from Chinon (CEIDRE) because the main purpose is directed towards the long term actions. Timely sampling from containment atmosphere is important as thereafter the samples need to be analysed, the results evaluated to a format of release potential.

In the emergency organization the plant manager and his deputy act as spokespersons. The plant is prepared to host mass media on-site visits at the visitor building; close to the access building. At the corporate level EDF has in Paris a media centre equivalent to TV studio class.

The Local Information Committee (CLI) has been active since 1980; Saint Laurent CLI co-operates with similar CLIs at Chinon, Dampierre and Belleville. Different local interest parties (politically elected representatives of communes, environmental protection organizations, trade unions, commercial enterprises, prefect) are represented at this committee. This is an example of public outreach by the plant and EDF.

According to an international practice, the NPPs together with relevant off-site rescue service authorities inform the local population about radiation accidents and actions to be taken after a national alert signal.

CLI, along with authorities responsible for rescue service together with EDF have developed and printed a brochure about radiation accidents and actions after a general alarm. This brochure has been distributed to every home within 10 km, in 2002. During the OSART the chairman of CLI expressed in a constructive manner interest to renew the information in the brochure and redistribute it.

In 2006, the local off-site authorities distributed iodine tablets (one box containing 10 tablets) to each household and working place within 10 km. The same envelope also contained a letter signed by the Directeur Général de la Sûreté Nucléaire et de la Radioprotection and the Préfet, Directeur de la Défense et de la Sécurité Civiles and a leaflet containing the necessary information about actions in case of a radiological accident. Activities to renew this distribution in 2009 has been activated by the national safety authority ASN.

### 9.3. EMERGENCY PLANS AND ORGANIZATION

Saint Laurent NPP has written agreements with the local fire brigade, the ambulance service (SAMU), bus company, town of Muides (concerning screening and decontamination building used both for radiological emergencies and for sports), prefecture, on national level with Meteorological institute (Meteo France) and military hospitals and with the NPP vendor (AREVA) and EDF on a national and regional level. The team identified the open and continuous contact with external organizations as a good practice.

In case of an incident the shift manager contacts PCD1 who defines the emergency class and can activate the alarms of on-site personnel and off-site authorities. the prefect can activate an emergency adapted to radiological hazards (PPI) in 3 phases:

- 1 "Wait and see" -mode
- 2 "Fast developing accidents" -mode (release may start within 6 h)
- 3 "Discussion" -mode in which the management of the organization has been set up.

The procedurized instructions to inform the department even in less severe incidents than site emergency increases the confidence and gives the off-site authorities time to increase their preparedness.

Saint Laurent NPP is located just a few km from the border of departments (préfect) of Loir-et-Cher and Loiret. These departments have worked together for an off-site emergency plan. The off-site emergency organization is led by the prefect of Loir-et-Cher; his staff has a management facility (PCF) in Blois with an operational centre (PCO) to be placed on a low risk area closer to NPP. The off-site emergency planning zones covers areas up to 2/5/10/50 km. Within 2 km of Saint Laurent NPP, there are about 4800 inhabitants and within 10 km about 30 000 inhabitants.

A potential sheltering would decrease thyroid dose by 70% and external dose rate by 90 %. According to some experience from chemical accidents in a case of evacuation 25 % of population would need public transportation. The PPI plan includes also the possibility of closing the railway line (2...3 km from the NPP) and highway A10 (4...5 km from the plant). The department has included also economic compensation functions in the PPI plan through the presence of EDF insurance representatives.

The current PPI plan dates to 2002 and the review period is five years at maximum; therefore Saint Laurent NPP is going to be in co-operation in updating PPI plan and keeping it consistent with PUI plan.

#### 9.4. EMERGENCY PROCEDURES

The plant has a weekly on-call list of 62 out of 310 persons who are obliged to be either at work, at home within 30 minutes traveling time at the most or travelling between these two points. The individuals are contacted by text messages to pagers and audio message to home telephones. Mobile phones are not used in this automatic alarming process.

The PCC has a key role in assessing the environmental doses and dose rates. Its emergency plan implementing procedure contains pre-calculated sheets based on releases caused by design basis accidents.

The original design base of the safety systems has been to maintain the reactor cooling during a major loss of coolant accident (LOCA). Later the plant has been back-fitted with a system which should exclude major radioactive releases to the environment even in the case of core melt. Containment design leak rate is tested with a pressure test every 10 years and all penetrations are inspected annually. However, the containment leak might exceed design rate due to containment failure or bypass.

In case of a containment failure or by-pass, the assessment of radioactive releases to the environment is based on monitoring radiation in the containment, stack and near site. The plant prefers this method though it is not as conservative as to use already in an earlier phase theoretical conservative assumptions done for each type of accident.

The plant is encouraged to continue keeping potential containment failure or by-pass modes in its accident scenarios related to emergency preparedness training including methods for assessing the environmental doses and dose rates when there is uncertainty concerning containment functioning into the PCC training and procedures.

The plant has comprehensive equipment to conduct radiological surveys on-site and with two vans also near-site. They are able to track external radiation, surface and airborne contamination and protect the monitoring teams

#### 9.5. EMERGENCY RESPONSE FACILITIES.

Several on-site emergency centres are established to carry out the emergency response functions. With the local responders from the main control room area functions, the PCL ensure that operations go on, that rescue to injured is done and the first decision for fire fighting are made. The main command centre (PCD) ensures emergency managing and coordinating, the on-site and off-site radiological assessments and measurements are provided by the assessment emergency centre (PCC), public information activities are performed by the communication unit and logistic support, protective and corrective actions are made by logistic emergency centre (PCM). The technical evaluation and control room (CR) support is performed from LTC (close to CR of unit 2). Emergency response facilities in the control room building and security building have a ventilation system which can filter most of the iodines and aerosols and maintain overpressure.

The corporate level facilities in Paris at St. Denis and Wagram have a high level preparedness for emergencies. St. Denis facility has real time access to important local site safety parameters through displays from plant process information systems (KIT & KPS).

The plant management has a dedicated emergency response center (PCD) in the security building. Adjacent to that there is the radiation control centre (PCC) and logistic center (PCM). They are close to the security control room (PCP), which activates the automatic alarm of the organization. The security control room has also displays to vital locations at the site.

Local Emergency response team (ELC) functions in LTC, close to the control room at unit 2. In case of a radioactive release, the control room (CR) and LTC ventilation will automatically switch to filtration mode. However, periodical test to verify the habitability of the CR is not conducted. The team made a recommendation in this area.

At corporate level in Paris EdF has a representative management center in Wagram and an engineering support center in St.Denis. The site LTC and Paris St.Denis centres have real time access to plant process information (KIT & KPS).

## 9.6. EMERGENCY EQUIPMENT AND RESOURCES

The plant follows the environmental radiation with eight real-time radiation monitors near site and with eight monitors at 10 km; the readings of the monitors from this external circle are going to be automatically available at the plant in 2008. The plant maintains two fully equipped vans for radiological monitoring.

In case of fire, the fire alarm must be confirmed by a first line or the first witness of fire is the first to dial 18. The second line consists of trained field operators and third line comes from a partially voluntary fire brigade at a distance of 3 minutes from the plant. The fire brigade is able to dispatch units to the site within 5...8 min. It has a total of 33 fire fighters among them four are professional and eleven work normally at Saint Laurent NPP. The ambulance has a kit also for patients with radiological contamination. The fire brigade demonstrated a thorough knowledge in radiation protection and equipment for radiological monitoring and personnel decontamination; in addition, they have close co-operation with other rescue service organizations (fire brigades, ambulances, decontamination unit from a military base); recently, they have practiced evacuation drills with a small village, a junior school and one house for elderly people.

The plant has a doctor, a nurse and an ambulance always available. All the operators and a majority of plant staff have been trained to give first aid; the skills are validated by annual refresher course.

The plant has used for a long time system called GEEE for assessing off-site doses. It presents the dose estimates conservatively compared to releases. However, if the releases exceed the containment design basis the release rate is assessed by comparing the radiation in the stack or in the environment. Weather data comes first hand from an on-site SODAR with a 10 m high weather mast as back-up for wind measurements. GEEE uses only two wind turbulence classes (stable / unstable) and the width of the sector angle is chosen from a table according to wind speed & turbulence and release duration. EDF is researching the possibility of ordering a new system called C<sup>3x</sup>. This is a unique time for plant personnel, EPP unit and PCC personnel to contribute with a user's input for a system that will be used by EdF NPPs for at least one decade. The plant is encouraged to make use of more accurate methods for plume dispersion calculation when replacing the GEEE software.

Medical and health care on-site is well prepared both in general and in detail for taking care of contaminated patients needing health care. The team identified this as a good practice.

There are nine clearly marked muster stations at the plant. The personnel accounting at nine muster places is done properly with a computerized system (ADEL). The personnel is organized in queues and then each person registers in by their security badge. This includes the personal information including the position in the emergency organization; this feature speeds up the activation of emergency organization and evacuation of unnecessary people. This system maintains a real-time data base of the personnel on site in an all the time changing situation.

The plant medical center can check the contamination and decontaminate effectively up to 50 persons. In need of larger contamination monitoring and decontamination the personnel is transported by busses over 10 km to a screening and decontamination station, which has been designed by EDF especially for this purpose; in case of activation of this station, the on-line



personnel accounting system at muster stations (ADEL) screens from muster stations those (37) individuals who have the training and responsibility to set up the fall-back station. After the prompt activation of the muster station the buses, which are available according to readiness agreement, bring in the personnel who need screening for contamination. The non-contaminated individuals are led to exit doors and contaminated to upper floor where they – men and women in separated lines - are carefully decontaminated and given new clothes replacing the contaminated ones. Personal valuables are screened for contamination and handled with special care. Decontamination waters are treated separately.

This whole process is not only procedure based but thanks to several large drills also performance based. The team identified it as a good performance.

## 9.7. TRAINING, DRILLS AND EXERCISES

EPP training consists of initial training before entering the on-call list and refresher training thereafter. This training contains both mandatory and recommended items. Each employee has to participate in introduction training before starting work at Saint Laurent NPP. This gives information on alarm signs and expected conduct of work and actions thereafter.

The individuals appointed to the on-call list have to participate in the EPP job position specific training. The successful completion of initial training is a requirement in order to be placed on the on-call list. After being approved on the list, each person has to participate to annual real-time co-operation exercises, called global exercises. The EPP engineer keeps a record which includes for each emergency facility a table in which lists in rows each job position and individuals trained for that and in columns different training modules and their relevance (mandatory / recommended / none).

Severe accident management and phenomena are included in the refresher training of PCL, ELC and PCC personnel. EDF conducts PSA studies at the corporate level. The studies would give information about (the very improbable) accident sequences leading to simultaneous core melt and major leaks to the environment. This information is useful in increasing the knowledge of severe accidents among the plant emergency organization.

The feedback from EPP training is evaluated and actions are taken e.g. developing the EPP training. As an example the PCC1 has trained LTC personnel on how they are expected to inform PCC on plant safety situation in order to assess the development of the radiological situation.

Numerous interviews demonstrated that the EPP organization is highly knowledgeable and skillful for their EPP activities though some specific development items were noted as needing improvement. These were related to severe accident management and phenomena and accident sequences more severe than design basis.

The plant carries out annually numerous mobilization exercises and so many real-time simulator scenario exercises that each person can participate in an annual basis. In order to ensure the fulfillment of these criteria combined to the organizing process of the exercise the individuals on the on-call list can well in advance choose a suitable day and register themselves via intranet for a specific EPP exercise team.

Once in 2 or 3 years there is a national level exercise including EDF headquarters in Paris and every three years also the local off-site authorities participate. Saint Laurent plant makes use

of this exercise to inform the inhabitants in the plant vicinity about exercise and protective actions.

The real-time exercises make use of the on-site simulator which can simulate disturbances up to 600-800°C core outlet temperatures and transmit the KIT/KPS data to EDF Paris emergency facilities and to nuclear safety authorities. With higher core temperatures, the simulator is unable to simulate the plant process.

The radioactive part of scenario is planned separately from the simulator but according to exercise plans they are due to fit together. The real-time exercises have included also shift turnovers.

In the exercise in October 2005 in which also off-site authorities participated, the protective action design criteria were estimated to be exceeded, but finally the actual (simulated) release stayed minimal. In an internal exercise in 2004 the accident scenario included both core damage and containment failure with leak rate over design criteria. The plant is encouraged to include also releases exceeding design basis to exercise accident scenarios, especially because their quantitative estimation requires special skills and knowledge plus engineering judgement.

Emergency organization consists of plant personnel whose competence is dependent on their ground education, work experience, job position and emergency preparedness (PUI) training. EPP training consists of initial training before entering the on-call list and refresher training thereafter. This training contains both mandatory and recommended items.

For the time being there are 310 persons (plant staff totaling 700) on the on-call list: 62 of them are all the time in readiness to be active in their emergency facility within 1 hour from the alarm signal. For each position there are several (typically four to five) individuals who all have the appropriate competence for their EPP tasks. Each of them has an annual qualification for EPP organization which will expire automatically if the annual training is inadequate. Last year the success rate exceeded 99%. In addition to topical training each individual on the on-call list is active in one annual real-time co-operation exercise. Before entering the on-call list each individual observes one real-time co-operation exercise.

The plant maintains in their intranet an on-line registration system for real-time co-operation exercises. It allows:

- each individual to see their current EPP training status, the coming training modules including dates;
- each individual to choose the most suitable date from several options and at the same time see the situation of their colleagues;
- the line managers look after that all their personnel maintains their EPP competence;
- the EPP engineer to send a reminder to those individuals - and their line managers - whose last chance training session is approaching;
- the exercise organization to rely on the fact that a whole team is present during the exercise (avoiding confusion caused by sudden changes close to the exercise).

In addition to above the EPP engineer maintains a data base of the topical training related to each job position in EPP organization. This register allows also a critical evaluation of EPP training program for each job position. This option for seeking potential development areas has been made use of by EPP engineer, EPP commission and OSART.

The EPP engineer plans the training program so that each individual receives enough topical training before real-time co-operation exercises. The public intranet EPP training record encourages plant staff to demonstrate their own initiative to EPP training and is a sign of high safety culture.

The team identified this coordination as a good performance.

## 9.8. QUALITY ASSURANCE

The plant quality assurance unit conducts independent audits on EPP. Visits to the site emergency facilities - control room, PCL and ELC as well as PCD, PCC and PCM in the security building and also the corporate level emergency facilities in Paris gave the team an impression that all the facilities and every item have been continuously maintained in full readiness. The feedback from drills and exercises is analyzed and appropriate improvements are conducted.

### **SAINT LAURENT NPP FOLLOW-UP SELF ASSESSMENT**

The recommendation on habitability of the main control room and emergency operations centre in the event of an emergency has been implemented. The plant's response to this recommendation has shown that St Laurent NPP complies with reference standards.

In addition to the two conformance tests performed during the outages in 2008, the plant has taken the lead in efforts to improve this system on behalf of the French nuclear fleet, as part of a specific corporate project.

In view of the evidence provided by the test, as well as a more comprehensive awareness of the issue throughout the fleet, this recommendation has taken the plant a step forward in terms of nuclear safety.

### **STATUS AT OSART FOLLOW-UP VISIT**

The plant performed a thorough analyse of operation of the ventilation system of MCR and TLC (vital area) and introduced a new test procedure. Based on it the plant performed the leak tightness test of the vital areas. The results of the tests proved that the habitability of the control rooms is not compromised during emergency circumstances.

## DETAILED EMERGENCY PLANNING AND PREPAREDNESS FINDINGS

### 9.5. EMERGENCY RESPONSE FACILITIES

**9.5(1) Issue:** The safe and reliable operating conditions for the control room operating personnel are not periodically tested to verify the habitability of the control room in configuration of an emergency with radiological on site impact.

During the observation of the control room habitability by the OSART it has been revealed that there is lack of evidence of control room overpressure in emergency conditions in the plant's current configuration. According to the plant design the vital area including the control room and the Local Technical Centre (LTC) has been equipped with ventilation system including an iodine filter unit. In normal operation conditions the ventilators take air from two sources, from the external environment and from the different operational rooms of the vital area which are located on three elevations. In case of an accident with site radiological consequences, the intake from outside automatically switches over to the iodine filter unit but in the same time the airflow from the vital area rooms to the ventilators is continuing. The vital area is not sealed when the two fire doors next to the control room connecting the vital area with the tagging office area are not closed. According to the pressure test performed in 1998 a slight overpressure can be maintained in the vital area. The plant has no evidence of the results of the performed test.

For maintaining this overpressure a certain tightness of the vital area needs to be demonstrated. This requires from the design point of view control of leaks to the outside through the different gaps and penetrations and an adjustment of the air suction from the vital area. This suction appears to take place for the control room of the space behind control room panels. With such an adjustment a given overpressure could be maintained while providing adequate flow for habitability and cooling of the vital areas including the control room.

From the operational point of view it would be necessary to periodically test the overpressure which is independent from the actuation of the iodine filters and so verify the adjustment of air supply, the suction, the control and tolerance of air leaks.

An extraordinary meeting of the plant's Safety Technical Committee was held in order to clarify the concern. As a consequence of the meeting further doubts remained regarding compliance with the safety requirements of habitability of control room. The chairperson of the committee has taken conservative measures and decided upon short term corrective actions, and analysis for any long term action has been launched.

Without adequate working conditions, the control room and the LTC personnel may not be adequately protected against radiation exposure during emergency situations with on site radiological impact.

**Recommendation:** The plant should develop a test procedure to periodically verify the adequacy of the conditions for habitability of the control room and the LTC for the operational personnel in case of an emergency with on site radiological impact.

## **IAEA Basis: DS 347 par. 6.1**

“The facilities and equipment used by the operating staff should be well maintained and adequate to support safe and reliable operation of the plant under all operating conditions.”

GS-R-2: 5.26. For facilities in threat category I or II emergency facilities shall be designated where the following will be performed in the different phases of the response: the coordination of on-site response actions; the co-ordination of local off-site response actions (radiological and conventional); the co-ordination of national response actions; co-ordination of public information; and co-ordination of off-site monitoring and assessment. Several of these activities may be performed at a single center and the location may change in the different phases of the response. These emergency facilities shall be suitably located and/or protected so as to enable the exposure of emergency workers to be managed in accordance with international standards.

### **Plant Response/Action:**

Further to this recommendation, the plant appointed an engineer to review the functionality of the control-room ventilation system. A member of the maintenance department in charge of ventilation equipment was appointed to assist him.

A three-stage action plan was drawn up:

1. Comprehensively review functionality of the entire MCR ventilation system.
2. On the basis of this review, determine any necessary adjustments to be carried out in the appropriate reactor conditions from a safety perspective (unit in outage).
3. Following investigation and adjustments, implement surveillance test procedure DVC 020, performed every cycle, in order to confirm compliance with the criteria stipulated by our operating rules

### Review of MCR ventilation system – adjustments.

Investigations were performed by the ventilation system manufacturer under site supervision, and were split into two stages:

Equipment investigations:

- Equipment integrity, cleanliness of suction grids, flaps and dampers,
- Room integrity,
- Absence of malfunctions liable to compromise functionality or proper air flow,
- No impact on system functionality caused by plant modifications.

Investigations conducted on both units did not reveal any damage that could compromise system functionality.

Aeraulic investigations:

- Overpressure monitoring (MCR and emergency operations centre),
- Airflow monitoring at air intake and outlet points.

### Unit 1:

Test results have shown that MCR overpressure is amply maintained by a large differential between air supply (in line with expected values) and extraction values, which must be lower than the supply flow.

Functional iodine filter tests were also satisfactory. Overpressure is maintained in the MCR and emergency operations centre, in normal configuration as well as in iodine filter configuration. Overpressure checks were performed by measuring air supply and extraction rates, and were verified using a smoke generator.

#### Unit 2:

Test results showed that measured values were incorrect in certain rooms. A few dampers were therefore adjusted in order to obtain the expected values, mainly in the MCR and emergency operations centre.

Functional iodine filter tests were also satisfactory. Overpressure is maintained in the MCR and emergency operations centre, in normal configuration as well as in iodine filter configuration. Overpressure checks were performed by measuring air supply and extraction rates, and were verified using a smoke generator.

#### Implementation of surveillance test procedure

Surveillance test procedure EPC DVC 020 was applied by Operations on both units. It was applied on unit 2 on 22 March 2008 and on unit 1 on 18 May 2008, during the outage period. All operating rule criteria were met and obtained upon the first attempt on both units.

The surveillance test is due to be performed again on both units in the 1<sup>st</sup> half of 2009.

The entire investigation has been incorporated into a corporate enquiry.

#### **Conclusion**

Our investigations, tests and adjustments have proved that the MCR and emergency operations centre fulfil the habitability criteria for operations staff in the event of an emergency with radiological consequences for the site.

#### **IAEA comments:**

To meet the expectation defined by the OSART team the plant appointed a task-team with the necessary expertise to analyse the operation of the ventilation system of the MCR and TLC. The thorough analysis, which included a comprehensive functional review of the system and the necessary adjustments of its equipment did not reveal any inconsistency which could compromise the functionality of the system. Based on that, the plant introduced a new surveillance procedure. The surveillance tests performed on Units 1. and 2. confirmed, that the ventilation system is able to maintain necessary overpressure in the vital area during normal and emergency circumstances. The plant, in cooperation with EDF corporate level, will improve the test efficiency by introducing a modified procedure. Therefore during the 2009 outages the plant intends to improve the system's equipment in order to guarantee its long term availability and to comply with future national standards.

**Conclusion:** Issue resolved

**SUMMARY OF STATUS OF RECOMMENDATIONS AND SUGGESTIONS  
OF THE OSART MISSION TO ST LAURENT NPP - OCTOBER 2008**

	ISSUES PROPOSED	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS	WITH- DRAWN
Management, Organization, Administration	R : 1	1			
	S : 1	1			
Training and Qualification					
	S : 1	1			
Operations	R : 1		1		
	S : 4	3	1		
Maintenance	R : 1	1			
	S : 2	1	1		
Technical Support					
	S : 1		1		
Operating Experience					
	S : 1		1		
Radiation Protection					
	S : 2	2			
Chemistry					
	S : 2	1	1		
Emergency Planning and Preparedness	R : 1	1			
TOTAL R (%)	R : 4	3	1		
	100 %	75 %	25 %		
TOTAL S (%)	S : 14	9	5		
	100 %	64 %	36 %		
SUBTOTAL	18	12	6		
	100 %	67 %	33 %		



## DEFINITIONS

### DEFINITIONS – OSART MISSION

#### **Recommendation**

A recommendation is advice on what improvements in operational safety should be made in that activity or programme that has been evaluated. It is based on IAEA Safety Standards or proven, good international practices and addresses the root causes rather than the symptoms of the identified concern. It very often illustrates a proven method of striving for excellence, which reaches beyond minimum requirements. Recommendations are specific, realistic and designed to result in tangible improvements. Absence of recommendations can be interpreted as performance corresponding with proven international practices.

#### **Suggestion**

A suggestion is either an additional proposal in conjunction with a recommendation or may stand on its own following a discussion of the pertinent background. It may indirectly contribute to improvements in operational safety but is primarily intended to make a good performance more effective, to indicate useful expansions to existing programmes and to point out possible superior alternatives to ongoing work. In general, it is designed to stimulate the plant management and supporting staff to continue to consider ways and means for enhancing performance.

*Note: If an item is not well based enough to meet the criteria of a ‘suggestion’, but the expert or the team feels that mentioning it is still desirable, the given topic may be described in the text of the report using the phrase ‘encouragement’ (e.g. the team encouraged the plant to...).*

#### **Good Practice**

A good practice is an outstanding and proven performance, programme, activity or equipment in use that contributes directly or indirectly to operational safety and sustained good performance. A good practice is markedly superior to that observed elsewhere, not just the fulfillment of current requirements or expectations. It should be superior enough and have broad application to be brought to the attention of other nuclear power plants and be worthy of their consideration in the general drive for excellence. A good practice has the following characteristics:

- Novel;
- Has a proven benefit;
- Replicable (it can be used at other plants);
- Does not contradict an issue.

The attributes of a given ‘good practice’ (e.g. whether it is well implemented, or cost effective, or creative, or it has good results) should be explicitly stated in the description of the ‘good practice’.

*Note: An item may not meet all the criteria of a ‘good practice’, but still be worthy to take note of. In this case it may be referred as a ‘good performance’, and may be documented in the text of the report. A good performance is a superior objective that has been achieved or a good technique or programme that contributes directly or indirectly to operational safety and sustained good performance, that works well at the plant. However, it might not be necessary to recommend its adoption by other nuclear power plants, because of financial considerations, differences in design or other reasons.*

## DEFINITIONS - FOLLOW-UP VISIT

### **Issue resolved - Recommendation**

All necessary actions have been taken to deal with the root causes of the issue rather than to just eliminate the examples identified by the team. Management review has been carried out to ensure that actions taken have eliminated the issue. Actions have also been taken to check that it does not recur. Alternatively, the issue is no longer valid due to, for example, changes in the plant organization.

### **Satisfactory progress to date - Recommendation**

Actions have been taken, including root cause determination, which lead to a high level of confidence that the issue will be resolved in a reasonable time frame. These actions might include budget commitments, staffing, document preparation, increased or modified training, equipment purchase etc. This category implies that the recommendation could not reasonably have been resolved prior to the follow up visit, either due to its complexity or the need for long term actions to resolve it. This category also includes recommendations which have been resolved using temporary or informal methods, or when their resolution has only recently taken place and its effectiveness has not been fully assessed.

### **Insufficient progress to date - Recommendation**

Actions taken or planned do not lead to the conclusion that the issue will be resolved in a reasonable time frame. This category includes recommendations on which no action has been taken, unless this recommendation has been withdrawn.

### **Withdrawn - Recommendation**

The recommendation is not appropriate due, for example, to poor or incorrect definition of the original finding or its having minimal impact on safety.

### **Issue resolved - Suggestion**

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been fully implemented or the plant has rejected the suggestion for reasons acceptable to the follow-up team.

### **Satisfactory progress to date - Suggestion**

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been developed but not yet fully implemented.

### **Insufficient progress to date - Suggestion**

Consideration of the suggestion has not been sufficiently thorough. Additional consideration of the suggestion or the strengthening of improvement plans is necessary, as described in the IAEA comment.

### **Withdrawn – Suggestion**

The suggestion is not appropriate due, for example, to poor or incorrect definition of the original suggestion or its having minimal impact on safety.

## LIST OF IAEA REFERENCES (BASIS)

### *Safety Standards*

- Safety Series No.110**; The Safety of Nuclear Installations (Safety Fundamentals)
- Safety Series No.115**; International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources
- Safety Series No.120**; Radiation Protection and the Safety of Radiation Sources: (Safety Fundamentals)
- NS-R-1**; Safety of Nuclear Power Plants: Design Requirements
- NS-R-2**; Safety of Nuclear Power Plants: Operation (Safety Requirements)
- NS-G-1.1**; Software for Computer Based Systems Important to Safety in Nuclear Power Plants (Safety Guide)
- NS-G-2.1**; Fire Safety in the Operation of Nuclear Power Plants (Safety Guide)
- NS-G-2.2**; Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants (Safety Guide)
- NS-G-2.3**; Modifications to Nuclear Power Plants (Safety Guide)
- NS-G-2.4**; The Operating Organization for Nuclear Power Plants (Safety Guide)
- NS-G-2.5**; Core Management and Fuel Handling for Nuclear Power Plants (Safety Guide)
- NS-G-2.6**; Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants (Safety Guide)
- NS-G-2.7**; Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants (Safety Guide)
- NS-G-2.8**; Recruitment, Qualification and Training of Personnel for Nuclear Power Plants (Safety Guide)
- NS-G-2.9**; Commissioning for Nuclear Power Plants (Safety Guide)
- NS-G-2-10**; Periodic Safety Review of Nuclear Power Plants (Safety Guide)
- 50-SG-Q**; Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations (Code and Safety Guides Q8-Q14)
- RS-G-1.1**; Occupational Radiation Protection (Safety Guide)
- RS-G-1.2**; Assessment of Occupational Exposure Due to Intakes of Radionuclides (Safety Guide)
- RS-G-1.3**; Assessment of Occupational Exposure Due to External Sources of Radiation (Safety Guide)
- RS-G-1.4**; Building Competence in Radiation Protection and the Safe Use of Radiation Sources (Safety Guide)
- GS-R-2**; Preparedness and Response for a Nuclear or Radiological Emergency (Safety Requirements)

**GS-R-3;** The Management System for Facilities and Activities (Safety Requirements)

**GS-G-3.1;** Application of the Management System for Facilities and Activities (Safety Guide)

***INSAG, Safety Report Series***

**INSAG-4;** Safety Culture

**INSAG-10;** Defence in Depth in Nuclear Safety

**INSAG-12;** Basic Safety Principles for Nuclear Power Plants, 75-INSAG-3 Rev.1

**INSAG-13;** Management of Operational Safety in Nuclear Power Plants

**INSAG-14;** Safe Management of the Operating Lifetimes of Nuclear Power Plants

**INSAG-15;** Key Practical Issues In Strengthening Safety Culture

**INSAG-16;** Maintaining Knowledge, Training and Infrastructure for Research and Development in Nuclear Safety

**INSAG-17;** Independence in Regulatory Decision Making

**INSAG-18;** Managing Change in the Nuclear Industry: The Effects on Safety

**INSAG-19;** Maintaining the Design Integrity of Nuclear Installations Throughout Their Operating Life

**Safety Report Series No.11;** Developing Safety Culture in Nuclear Activities Practical Suggestions to Assist Progress

**Safety Report Series No.21;** Optimization of Radiation Protection in the Control of Occupational Exposure

***TECDOCs and IAEA Services Series***

**TECDOC-489;** Safety Aspects of Water Chemistry in Light Water Reactors

**IAEA Services Series 12;** OSART Guidelines 2005 Edition

**TECDOC-1329;** Safety culture in nuclear installations - Guidance for use in the enhancement of safety culture

**TECDOC-955;** Generic Assessment Procedures for Determining Protective Actions during a Reactor Accident

**EPR-METHOD-2003;** Method for developing arrangements for response to a nuclear or radiological emergency, (Updating IAEA-TECDOC-953)

**EPR-ENATOM-2002;** Emergency Notification and Assistance Technical Operations Manual

## **ACKNOWLEDGEMENT**

The Government of France, and the plant staff provided valuable support to the OSART mission to the Saint Laurent Nuclear Power Plant. Throughout preparation and conduct of the mission, the staff of the nuclear power plant provided support to the IAEA Operational Safety Section staff and the OSART team. Team members felt welcome and enjoyed good cooperation and productive dialogue with the managers of Saint Laurent NPP. This contributed significantly to the success of the mission. The managers, and especially the team's counterparts, engaged in frank, open discussions and joined with the team in seeking ways to strengthen the station's performance. The personal contacts made during the mission should promote continuing dialogue between the team members and the plant staff. The support of the host plant peer, interpreters and administrative staff was outstanding. Their help was professional and appreciated by the team.

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