



**IAEA**

International Atomic Energy Agency

**REPORT  
of the  
OPERATIONAL SAFETY REVIEW TEAM  
(OSART)**

**MISSION  
to the**

**PENLY  
Nuclear Power Plant**

**FRANCE**

**29 November – 15 December 2004**

**And**

**FOLLOW-UP VISIT  
2 – 5 May 2006**

**DIVISION OF NUCLEAR INSTALLATION SAFETY  
OPERATIONAL SAFETY REVIEW MISSION  
IAEA-NSNI/OSART/06/128F**

## **PREAMBLE**

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of the Penly Nuclear Power Plant, France. It includes recommendations for improvements affecting operational safety for consideration by the responsible French organizations and identifies good practices for consideration by other nuclear power plants.

Any use of or reference to this report that may be made by the competent Government of 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**, 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 Nuclear Safety Standards (NUSS) programme 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 judgments 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. It also includes the results of the follow-up visit that was requested by the competent authority of France for a check on the status of implementation of the OSART recommendations and suggestions.

## CONTENT

INTRODUCTION AND MAIN CONCLUSIONS .....	1
1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION.....	9
2. TRAINING AND QUALIFICATIONS.....	24
3. OPERATIONS.....	36
4. MAINTENANCE .....	59
5. TECHNICAL SUPPORT .....	73
6. OPERATING EXPERIENCE FEEDBACK.....	84
7. RADIATION PROTECTION.....	99
8. CHEMISTRY .....	118
9. EMERGENCY PLANNING AND PREPAREDNESS .....	128
DEFINITIONS .....	142
LIST of IAEA REFERENCES (Basis) .....	145
TEAM COMPOSITION OSART MISSION.....	148
TEAM COMPOSITION OSART FOLLOW-UP VISIT .....	150



## INTRODUCTION AND MAIN CONCLUSIONS

### INTRODUCTION

At the invitation of the Government of France, an Operational Safety Review Team (OSART) mission was conducted at the Penly Nuclear Power Plant (NPP) from 29 November to 15 December 2004. The plant is located about 15 kilometers (km) north of the town of Dieppe, sub-prefecture of Seine Maritime department in the Normandy region of France. Paris is about 160 km to the southeast. The NPP site contains two 1300 MWE reactors. The first unit started its commercial operation in 1990 and the second unit in 1992. Both units have completed their 10-year outage inspection in 2002 and 2004 respectfully. 670 people work at Penly NPP and the median age of the staff is 40.

The Penly NPP OSART mission was the 128<sup>th</sup> in the OSART programme, which began in 1982. The team was composed of experts from Belgium, Brazil, Bulgaria, Canada, Japan, Netherlands, Sweden, Slovakia, the United States of America and a host plant peer from Penly NPP along with the IAEA staff. In addition, observers from the Russian Federation, China and Japan were part of the team. The collective nuclear power experience of the team was 380 years.

The team traveled to Penly NPP on Friday, 26 November 2004. Saturday and Sunday were spent in team training activities. Following the entrance meeting, which took place on Monday, 29 November; the team conducted the OSART review, completed the initial reports and presented its findings at an exit meeting on Wednesday, 15 December.

In addition to senior managers and staff from Penly NPP and EDF, representatives from the Nuclear Safety Authority (SNA) attended the entrance and exit meeting.

The purpose of the OSART 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, a comprehensive exchange of technical experience and knowledge took place between the experts and their plant counterparts on how improvements in operational safety could be further pursued.

Before visiting the plant, the team studied information provided by the IAEA and the Penly NPP to familiarise themselves with the plant's main features and operating performance, staff organization and responsibilities, important programmes and procedures and IAEA Safety Standards relevant to the mission. During the mission, the team reviewed many of the plant's programmes and procedures in depth, examined the plant's performance, observed work in progress, and held in-depth discussions with plant personnel, SNA staff and off-site authorities. Throughout the review, the exchange of information between the OSART team members and plant personnel was very open, professional and productive.

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 nuclear safety has received the highest priority from the managers and staff at Penly NPP. The team was impressed with the open, professional and productive approach that the Penly staff had toward the OSART mission. The staff's willingness to learn and their enthusiasm and commitment to improve the operational safety of the plant was considered a strength.

The team found the following good practices and performances, which are further described in the report:

- Successful progressive approach to management presence in the field
- Comprehensive oversight and control of work practices and risk assessments
- A global approach for enhancing nuclear safety management
- Excellent work management systems
- Comprehensive emergency exercises with good redundancy of emergency plan aspects
- Excellent management of radioactive waste inventory

The plant has embarked in a serious programme to improve the overall material condition and operational safety of the plant. The team found significant progress towards improvements in many areas and encourages plant management and all staff to continue to give the continuation of these improvements a high priority. With this purpose, the team offered proposals for further improvements in operational safety. The most significant proposals include the following:

- As the material condition of the plant improves, plant management should seize the opportunity to raise standards and improve plant patrols across the entire site
- Improve inspections of fire protection systems
- Review, and consider improvements to the conduct of operations in the main control room
- Improve guidelines for the development and conduct of training
- Review and consider improving present practices of trend analysis
- Develop guidelines to better control analysis of local events
- Improve the timely actuation of EPP assembly points outside of normal working hours and the timely accounting of people that may be injured or trapped inside the RCA following an evacuation.

The OSART team concluded that there is a strong commitment to nuclear safety by the management and staff at Penly NPP. The Penly plant management team that contributed to the excellent preparation for the OSART mission and all the plant staff that worked so hard to prepare for this mission need to be recognized for their true commitment to operational safety.

All plant staff is encouraged to continue with their efforts for sustaining the momentum to improve the material condition of the plant and to support management efforts to improve the processes and programmes that support these efforts. Senior managers are also encouraged to continue with their initiative to promote a strong safety management environment in accordance with developments promoted by the IAEA and other world organizations. The implementation



of the OSART recommendations and suggestions will strongly contribute to management's support of their expectations in this area and help enable the Penly NPP to be recognized as an International top safety performer in the nuclear industry.

Penly NPP management expressed a determination to address the areas identified for improvement and indicated a willingness to invite a follow up visit in about eighteen months.

## **PENLY NPP FOLLOW-UP MAIN CONCLUSIONS [PLANT SELF-ASSESSMENT]**

The OSART review conducted at Penly NPP in December 2004 was a highlight for each and every one of our staff members. It was indeed an occasion where we were given credit for our good practices. But above all, it was the areas for improvement, astutely identified by the team of international reviewers that was particularly enlightening.

The "OSART label" is a valuable tool for relaying our good practices to work teams and the general public, as well as being a valuable asset for maximising their potential. It is also a catalyst which provides impetus for corrective actions taken in response to recommendations and suggestions.

As one of its foremost objectives for which it has set up a coordinated project-based oversight structure, Penly senior management - in conjunction with the same people involved in the OSART preparations - has decided to take the OSART dynamic even further. This team has met a number of times in order to come up with the most effective responses to the reviewers' recommendations and suggestions.

Far-reaching efforts have been made in order to tackle the 8 recommendations and 17 suggestions and get everyone involved, including EDF staff and contractors. This "mini handbook" sets out each of our responses. The OSART follow-up mission will provide an opportunity for assessing their relevance as well as the progress made in striving for continuously improving standards of nuclear safety.

We have worked along three lines:

- ✓ Maximising the potential of our good practices, acknowledged by the IAEA,
- ✓ Perfecting our practices,
- ✓ Continuing to improve equipment condition.

The good practice that immediately springs to mind is that of management presence in the field, which sets nuclear safety as an absolute priority.

This approach is now firmly entrenched within our culture. It is operational (1700 recorded inspections in 2005), it is acknowledged by staff (workers approve of it and people from other plants come to see us) and it is managed in such a way as to achieve high standards of performance (structured management presence plan for power operations and outage, reviews based on lines of defence, observation of our human performance tools).

In the same spirit, we are continuing to conduct self-assessments within the departments and work teams. We are also furthering our efforts to manage skills with the help of structured tools (skills mapping, skills assessment in the field, improved tutor training thanks to the OSART recommendation). The good practice in the chemistry area regarding nuclear and

industrial safety hazard identification sheets was extended to all departments at the end of 2005.

Thanks to the OSART mission, we have successfully initiated cultural changes in order to roll out our human performance programme (a few trials were conducted on simulator in 2005).

Continuous improvement of nuclear safety is our goal. A number of years will be needed to fully gauge the effects of our efforts, but the operations and I&C departments have already starting working to make activities involving reactor trip risks more secure. Management presence in the field is used to observe implementation of these human performance tools.

The OSART mission provided us with an excellent opportunity for improving plant and material condition.

At present, we are in the best quartile of the French nuclear fleet. Equipment is regularly monitored. At the beginning of 2005, we started refurbishing our two pump houses, with work scheduled up until 2007. A long-term schedule spanning the period from 2006 - 2011 will help us to achieve international plant and material condition standards. The fight against corrosion is one of the main focuses. In order to make housekeeping a fundamental aspect of our behaviour, the safety/quality refresher course for years 2006 – 2008, attended by all staff members, devotes half a day to the subject of plant and material condition.

In 2005, our performance in the areas of nuclear safety, power generation and industrial safety fell short of our performance in 2004.

This is clearly illustrated by the poor results of the unit-1 maintenance outage which took place in the first half of the year. We did not meet our planning target set at 4 months before outage start. The valve contractor was only identified 15 days prior to the outage. We were forced to deal with 20 to 30% of unplanned valve maintenance and reported 11 safety-significant events.

The plant senior management team carried out a full diagnosis and at the end of 2005 took the necessary actions to rectify this drift. In order to improve our performance, we are therefore focusing on the areas of human performance, forward-planning and receptiveness.

The responsive and enthusiastic attitude of Penly staff is of the greatest value to us. It was this responsiveness that enabled us, right in the middle of August 2005, to bring the unit-2 outage forward by 4 weeks owing to a problem with the condenser. However, responsiveness alone is not enough.

We have set ourselves three key objectives for year 2006:

- ✓ a successful OSART follow-up mission,
- ✓ a successful unit-1 outage in summer. The efforts we have made in forward-planning have enabled us, for the first time, to meet our planning target of 4 months before outage start. We have adopted the same approach to planning for the two major outages scheduled for 2007,
- ✓ performance management, in order to always be a step ahead.

We have received a number of delegations of international operators: seven Canadian senior plant managers from Ontario Power Generation, Bruce Power and Duke Power, six managers from the Sellafield reprocessing plant in England and one EDF-employee working at Farley

NPP in the USA. All of them expressed their own views on our practices. Our discussions with them helped us to readjust or reinforce our actions. This bears testimony to our resolutely open attitude.

The OSART mission conducted in 2004 has set Penly on a course of improvement. Our efforts will not cease after the OSART follow-up mission! Our strategic plan ensures that far-reaching initiatives already underway will continue over the period of 2006 – 2010.

Such is the case for the first strategic principle which deals with the implementation of human performance tools and the improvement of plant and material condition.

## **OSART FOLLOW-UP MAIN CONCLUSIONS**

The team performed an in-depth review of the actions taken for each recommendation and suggestion and concluded the following for the Penly NPP OSART mission results;

**In the area of Management Organization and Administration**, the team concluded that Penly did an excellent job of addressing the issue of improving Human Performance evaluations.

The team concluded that Penly management has taken an excellent approach to analyzing the human performance needs of the plant. The plants ongoing initiative for management presence in the field, focusing on defense in depth, should prove to be very effective in identifying weak areas for improvement. The gradual implementation of human performance tools is an excellent approach for staff coaching and building teamwork between supervisors and workers.

The team concluded that full integration of human performance tools across the entire site will be extremely beneficial in the long term. The plants ability to reduce risks will be greatly enhanced through the use of human performance tools. The plant and senior management are encouraged to support the human performance initiatives already being implemented.

**In the area of Training and Qualification**, the OSART mission of 2004 made two recommendations and one suggestion, all of which were either resolved or satisfactory progressing to date during the follow-up visit.. The team concluded that the training department and the plant worked well together to establish good action plans to address all issues. The work done to establish good guidance and training for tutors was well received and appears to becoming effective. The plant is encouraged to continue their efforts in this area and couple the results with their efforts in human performance improvements.

The plant has addressed the issue of ensuring all contractors and other EDF staff requiring unescorted access receive the proper indoctrination. New posters and handouts were developed to aid training, along with a required test to ensure knowledge retention of industrial safety issues and rules.

The training department did a very good job of developing clear guidance for the development of training material to good pedagogical practices. The team concluded that this issue is resolved for all newly developed training files and slide outlines, and resolved very well using sound training methodology. The plant is encouraged to either phase out obsolete training files or put in the newly developed format.

Overall, the issues in the area of Training and Qualification were well analyzed with appropriate well thought out action plans for ensuring long term improvements.

**In the area of Operations**, the organization has taken a broad look at the issues identified by the OSART team in order to develop and implement actions to continue strengthening plant operations.

The team concluded the actions were comprehensive and will support continued improvement of the Operations department. Three of the issues are resolved and the other three are progressing satisfactorily.

The Operations Department has and is enhancing plant safety by reducing distractions to the Control Room operators and enhancing protection of the main control board panels. Clear guidance has been provided to the operators resulting in elimination of the potential for log or procedure errors from strike outs or use of white out.

Significant improvement in the material condition of the plant was noted during plant tours by the team. This is in part due to the enhanced guidance and training provided to the field operators. The plant staff recognizes this effort is not complete and will be an ongoing focus area.

The development and implementation of the six human performance tools will be beneficial to the organization. Full and consistent implementation of the tools will reduce the potential for errors. The organization is encouraged to continue the implementation of the tools.

The Operations department, site, and corporate organizations have fully identified the actions to address the fire protection issue identified by the OSART team. The evaluations, safety implications, and follow up actions were much broader and extensive than anticipated by the team. The progress being made is satisfactory and the actions are fully on track to be completed by the end of 2006 as scheduled.

**In the area of Maintenance**, the team has concluded that the Maintenance department has identified appropriate actions to resolve two of the three issues and have made significant progress on the third issue. The Maintenance organization is committed to improving plant material condition, improving contractor performance, and enhancing foreign material exclusion (FME) practices.

The organization implemented actions resolving the issues pertaining to the control of contractors and foreign material exclusion. Improvements in both of these areas will result in improved plant performance and safety.

The actions and plans laid out for the continual improvement of the site material condition are comprehensive and detailed. The actions taken to date have resulted in a marked improvement of areas such as the pump houses. The long term plans (2007-2010) are broad and when fully implemented will move the site material condition to a high level. The staff is commended and encouraged to continue these improvements.

**In the area of Technical Support**, the OSART mission of 2004 made one suggestion related to trend analysis.

An impressive programme for trending parameters of periodic surveillance tests and preventive maintenance data is being set up by the plant based on the WINSERVIR software application. The full implementation of the programme will allow the plant to detect early trends of deteriorating equipment performance or conditions, thus it will allow analysis of the

technical problems and the implementation of corrective actions before limits of unacceptable performance are reached. This way this programme is in line with the guiding principle of senior management to be more proactive and anticipative. The SURVAODIAG system used to monitor performance of rotating equipment has already brought its first tangible results of application.

Therefore the team concluded that the plant has achieved satisfactory progress in addressing the suggestion concerning trend analysis.

**In the area of Operating Experience**, the team concluded that the plant did a very good job in addressing each of the issues in this area. Local event analysis is being done very well, with the appropriate effort by senior management to ensure its effectiveness. Corrective actions are being closely monitored through the use of performance indicators, which ensure timely processing and control.

Significant events are being disseminated to all operations staff, given their significance and urgency. Senior management committees have been established to ensure events are properly prioritized and analyzed so as not to overload operations staff with information. The team concluded that the plant did a good job of organizing the work of the Safety Technical Committee so as to provide enough flexibility for this committee to function effectively in the area of OE. In addition, the operations department structured a very good process to ensure that all safety significant events are appropriately addressed to each shift member.

**In the area of Radiation Protection**, the OSART Mission of 2004 had made three suggestions. The plant has made a strong effort by resolving two of them and reaching satisfactory progress in response to the third one.

The actions the plant has selected as response to the OSART suggestion related to risk assessment aim to standardize and make more consistent the use of existing methods. The new approach will also call for an independent evaluation in majority of cases of outage works to ensure that risk management for the given work is appropriate.

However these changes to the process of individual industrial hazard prevention have not been implemented yet but are being prepared for application starting from July 2006.

The plant has introduced several actions in order to improve signposting of radiation and contamination risks. Dose rate is now uniformly expressed in mSv/h units what eliminates the potential for any confusion. Hot spots are signposted also in green zones. A new signposting system for contamination risks has been introduced. This was confirmed during the tour of the radiation controlled area of unit 2.

Since the OSART mission the plant has assigned more emphasis to the topic of radioactive waste production in the frame of the environmental management system. Several indicators have been selected to provide a more detailed characterization of the efforts to limit and reduce the production of radioactive waste. It is due to several extra modification and reconstruction activities that the ultimate goal of reducing the amount of solid radioactive waste could not be achieved in 2005.

**In the area of Chemistry**, the team found that the plant has reached satisfactory progress in response to the suggestion related to the quality control of operational chemicals and other substances.

The actions of the plant have been focused on labeling of chemical products stored not in their original container in order to ensure that information about the content of the container and associated hazards is available to anyone who might use the product or get in touch with it.

The plant tours to laboratories and stores provided both positive and negative results about the practical implementation of the new initiatives. This supports that the surveillance of labeling of chemicals as part of management controls when performing field tours is indeed required to ensure uniform application of the new requirements.

**In the area of Emergency Planning and Preparedness**, the OSART mission of 2004 made one recommendation and two suggestions. The recommendation and an associated suggestion are judged by the Follow-up team as having satisfactory progress to date. The second suggestion has been resolved.

Regarding the recommendation about timely accounting of staff and the suggestion about timely activation of assembly points in case of emergency the plant initiated a revision of the existing practice by contacting the EDF corporate organization.

EDF corporate organizations provided several responses to this inquiry since April 2005 to March 2006. Reviewing these responses it can be concluded that the goal set by EDF corporate organizations is to be able to account for people in 30 minutes after the notification of an emergency. Several options to reach this goal will be analyzed to determine their efficiency and cost impact. The solution selected after this analysis will be applied at all EDF plants, and will also solve the issue of timely activation of assembly points. The deadline to report the results of the feasibility study is November 2006.

At first sight this schedule of actions may appear not to be very ambitious, however considering the size of the EDF fleet, the desire to apply standardized process for accounting of people across all plant sites during emergencies and the cost impact of implementing the new methods for accounting it still can be judged as acceptable.

In response to the suggestion related to marking routes towards assembly points in the radiation controlled area the plant has modified the existing symbols and added new signs. The tour to the radiation controlled area of unit 2 has confirmed that the old signs have been systematically replaced in order to apply internationally accepted pictograms.

In summary, the team concluded that the plant has made remarkable and considerable efforts in improving the transparency and efficiency of human performance initiatives, and all concerned staff can now follow the progress in this area. Appropriate actions have also been taken by the plant for improved material condition and fire risk management. The operations and maintenance departments are working well together to achieve a risk free work environment. The initiative for management presence in the field is working well and has been instrumental in demonstrating trust and practical leadership.

Penly senior management expressed a determination to continue their strong momentum for improving plant safety and material condition, a willingness to be a leading example for continuous improvement and to share experiences in a global regime.



# 1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

## 1.1. ORGANIZATION AND ADMINISTRATION

Penly NPP reports to the Nuclear Generation Division of the EDF Group, Generation and Trading branch. There are three management levels implemented in the plant organizational structure, namely:

- Senior plant management
- Departments
- Basic working teams

A short management line allows for a short decision making process while keeping appropriate hierarchy in distribution of responsibilities and powers.

Organizational principles and structures are described in the Final Safety Analysis Report (FSAR) and each appropriate chapter is revised when a change to the organization is implemented.

Organizational charts of the utility and plant give a basic understanding of functions provided within the utility and the plant and those depending upon services outside of the company.

Clear division of responsibilities and authority between all parts of operating organization is described in the general organizational chart. It is a sound managerial tool.

Division of responsibility and authority between the plant and external organizations is thoroughly elaborated in mutual contracts. The contractor policy covers all aspects of relations of the plant to the contractors including but not limiting to radiation and industrial safety, quality assurance, risk prevention, environment protection etc. Yearly evaluation and ranking of contractors is an important element of maintaining the quality of work.

Distribution of safety responsibility is thoroughly described in the organizational documentation. A special chart is developed to support better understanding of the boundaries of responsibilities and lines of mutual cooperation. Plant personnel are aware of their responsibilities and cooperate with corporate organization.

Committees are usually chaired by the Plant Manager or Deputy Plant Manager. In such a case they are authorized to take a decision and delegate the tasks to the Heads of Departments. In a case when the committee is chaired by Technical Director he is authorized by the organizational chart to take the technical decision. Managerial aspects have to be approved by Deputy Plant Manager. The Technical Director is sometimes authorized on a case by case basis in writing to take decisions on behalf of plant manager. There is a valid general rule that committees can discuss the subject and propose conclusion. Managers are responsible for making the decision. They can accept conclusion proposed by the committee, they can take their own decision (change conclusion proposed by committee) or they can postpone the decision in time or refer it to the higher level of management.

The “Mission of the Nuclear Generation Division” is the basic document serving for clear division of the responsibilities between the corporate and plant management.

Corporate management monitors effectiveness of plant management by means of periodic status reports, irregular event reports, meetings and inspections.

Positions of all employees are described in organizational documentation. Positions of managers are described in the “Mission letter” specific to every position or in department management memos. These letters are in line with higher level of organizational documentation. The form of “Mission letter” is used for temporary assignment of whatever employee as needed. This gives flexibility to the organization to manage the tasks within a limited period of time, or to solve the problem of work performed rarely or on an ad-hock basis.

No signs of evidence of delayed safety-related works were observed during the mission. However, the custom of assignment of new tasks from corporate level to the plant without specification of financial resources was detected.

One of the principal policies is that “The change is an opportunity to grow”. This is applied in many areas including human resources. There is a good pool of experienced personnel in Penly. They gathered a lot of experience during the years of operation since startup of the units. EDF uses an advantage of national wide company experience. Personnel can be selected from or assigned to an appropriate site so a well balanced team can be built ensuring a high level of safety, reliability and productivity. Another advantage is the opportunity to ensure a good balance between internal promotion and recruitment from other sites or from external resources.

The national and local programme (Competence Mapping System) of replacement of retiring personnel is very well organized. Knowledge transfer is well structured with a long-term view (up to 2022). The programme is based on every single area of competence, how and when the change has to be organized. The date of change is estimated for every position. Lost skills and knowledge are identified. Assuming other factors such as development in area of safety, management improvement, company internal sources and sensitiveness of skills new requirements are defined. Based on previous steps the recruitment and training programme is defined. The team concluded that the competence mapping system is a good practice.

A formal system of yearly individual evaluation of staff has been established. Goals set for previous year are discussed; new goals and personal development are established. Evaluation of behaviour towards safety is an integral part of this process.

The corporate organization fulfils its supervisory and monitoring function by several means. There are organized meetings on the corporate level with participation of plant departments heads. The Nuclear Generation Division performs several in-depth performance reviews at the site per year (typically 3). Typical items of such reviews are performance safety and capability indicators review, yearly and medium term plan evaluation and so on. Very specific visits are organized on an ad-hock basis to review specific areas or item. The selection of items to be reviewed can be initiated by the plant or corporate and can be plant or fleet specific. EDF Nuclear Inspectorate performs its own inspections; one of them is a Pre-OSART inspection.

The Safety Review Committee meeting is held two times a year. Content, preparation, and overall organization of the meeting ensure high effectiveness of safety management. The meeting is lead by the plant manager in person, proving high priority given to the safety and authority of decisions taken.

The plant applies a policy of transparency in relation to the regulator. There is one contact point within the plant organization dealing with regulatory issues. A special system is in use to record and follow-up all contacts, tasks, issues related to the regulatory body. Data are regularly evaluated. Thanks to this no backlog was confirmed from the side of the regulator.



There are no resident inspectors in French regulatory practice but frequent contacts exist between the plant and regulator. Several types of inspections are applied (planned, non-announced and reactive). Technical meetings are held to direct the way of solution of specific issues.

The question of regulatory approval of guidelines of periodical tests remains open for several years.

Events are reported based on defined criteria and lines of communication are established. For the reason of transparency, the regulator has its own website providing the information on the safety supervision of all French NPPs including Penly.

Information on the NPP including the safety related information is published by the plant in a magazine which is circulated in the vicinity of the plant. The public information center at the entrance of the site provides information on NPP and various energy sources. This activity is supported by conferences organized in schools. Journalists are invited to the plant during outage time to get first hand information on the work being performed and high standards archived. Much information is available on the EDF Group web side.

The Technical Safety Group is established to deal with irregular expected safety and technical issues (long term activities e.g. for 10 years outage). These activities are planned and inputs originate from departments. The same body is assigned to deal with ad-hoc specific safety issues or problems in real time on request of plant manager, deputy plant manager or shift manager. The shift manager is authorized to convene the meeting of Technical Safety Group on-call whenever needed outside of working hours.

Corrective actions of the Technical Safety Group are followed in the plant management system and it is a subject of every meeting.

An extremely well established monitoring system is in place to provide early warning of negative trends in managerial lines of defense. The results are presented at regular meetings to plant management. The team concluded that it is a good practice [see 6.4(a)].

Organizational changes are arranged to strengthen those lines of defense which were identified as fragile. Safety implications of the proposed change are thoroughly evaluated using special guidelines based on INSAG 13. Conclusions are discussed and measures implemented. Thanks to short management lines the change is rapidly communicated to the staff.

## 1.2. MANAGEMENT ACTIVITIES

Quality meetings are organized with participation of the entire plant staff. Plant goals and objectives are communicated and discussed.

There are annual contracts with the staff and shift teams. They are detailed and comprehensive. Site and department goals are listed. Personnel development is identified and discussed, core skills – communications, rigour, etc. are reviewed; the department manager conducts review with all staff members of the department under his supervision.

Significant in-the-field presence of management is a powerful tool for communication between management and staff. It serves to encourage staff, correct deficiencies and note any difficulties. The team concluded that management presence in the field is good practice.

The work management review and work history review, along with the incorporation of suggestions and feedback from workers is highly appreciated. Information about this process

was obtained in several groups. A network is created for basic work teams to discuss common management issues and to be supportive for each other.

Plant projects are set up to mobilize the cross-departmental collaboration. Two long term projects are organized on the site. One of them is the plant unit outage project, and the other is the plant unit in operation project. Positive results of the projects were identified by series of indicators related to the plant safety and availability. This proves the quality of the managerial aspects of the projects.

Administrative documents are at use to cover all aspects of operation of the plant. Those of them which are related to the safety aspects of operation are included in the Quality Manual. This is a significant feature to ensure high quality of documents.

Plant management pays high attention to the environmental aspects of all kinds of activities. Formal confirmation of this is the certificate of ISO 14 001, which was obtained by the plant in 2002.

Regular weekly meetings are used to monitor progress towards achievement of goals and objectives. Corrective actions are applied as needed.

A wide scope of performance indicators is in place covering the activities on the plant and departments levels. Key safety and performance indicators are monitored weekly and compared against goals and objectives. Trend analyses are frequently used to allow for timely corrective actions settings. As the trend analyses are used for evaluation of managerial lines of defence, it provides a possibility to plant management to have a clear understanding of the most important strengths and weaknesses. An example of this was confirmed in daily contacts of the team members with the counterparts.

Department managers are very active in development of department specific indicators, methods of evaluation of indicators and the department staff are involved in the overall process management in achieving goals and objectives.

Deterministic safety analyses are done in the Final Safety Analysis report. The report is generic for the series of the 1300 MW units and contains a chapter dealing with specifics of each particular unit. The list of safety related modifications is available.

Probabilistic safety analyses are performed at the corporate level. The conclusions of probabilistic safety analyses are implemented in documents provided from corporate level to the plant.

The risk analyses are systematically used and appropriate measures are applied to compensate for risk identified. This practice was observed in several departments during the mission. It is a significant contributor to the overall risk reduction as detected by improvement of several indicators. However, some improvement is proposed by the team in radiation protection area [see 7.2(1)].

### 1.3. MANAGEMENT OF SAFETY

#### SAFETY CULTURE EVALUATION

During the review the team has noted several organizational features, initiatives and work practices, which are characteristic of or related to the safety culture at Penly NPP. The team

brings these observations to the attention of the plant management, to support their evident effort to further strengthen the safety culture prevailing in the organization.

Penly NPP has a well structured organization. The plant can take advantage of a strong and qualified support from the corporate level of EDF.

A conscious strive for improvement, an approach with an “open and learning mind” is a basic element of plant policies. While the plant management sets the goals for the organization on the plant level, the department managers enjoy freedom to define their own improvement programmes. This approach keeps middle level management and the staff motivated to come up with initiatives, and also results in a feeling of ownership for the applied processes.

The strong commitment of plant management to improve safety culture was evident for the OSART team. Visibly noted, the most powerful tool to achieve this goal is the “Presence of management in the field” programme.

The enthusiastic management team of the plant is willing to accept its responsibilities (no one is trying to pass over his or her responsibility to other parts of the organization). The team repeatedly observed that medium level managers are proud to demonstrate the plant’s results and eager to acquire experience from the OSART team members. It was obvious that the staff have nothing to hide from the review, and they are looking forward for a positive impact from OSART mission on the future development of the plant programmes.

Management has started several projects to engage the workforce in the development of a learning culture, which is important in an environment where the French electricity market is opening up for competition.

An important element of the learning culture is operating experience feedback, which plays a decisive role in the decision making process. It was satisfying to observe that in most work processes operating experience is used in a practical way, e.g. it is used in risk analysis, working package preparation, pre-job briefing. At the same time the team had the impression that in some cases plant personnel do not understand those processes beyond the boundary of plant responsibilities, which are handled at EDF corporate level. Operating experience feedback is well organized from other French NPPs, but it seems that plant staff are not aware of all significant events which have recently taken place at foreign NPPs.

The team noted some instances of overconfidence/reliance on the well-engineered plant design and proven plant processes to prevent human errors. Frequently an assumption was felt that each member of the staff would do his/her job correctly. This assumption is probably based on the good operating history of the plant and the French nuclear fleet in general. The team concluded on the basis of the experience of its members, that more wide use at Penly NPP of tools applied in the nuclear industry to avoid occurrence of events (self-checking, double checking, the “Stop, Think, Act, Review” method, independent verification) would strengthen the defence in depth of the plant’s operational safety.

In some cases the team felt a lack of questioning attitude on behalf of the plant staff. Compliance with national regulations or procedures applied EDF wide still would allow to be more opened to the diversity of alternative solutions that can be found in the international community of the nuclear industry. More active participation of the Penly staff in international peer reviews, IAEA and WANO programmes could facilitate a change in this respect.

It was the strong opinion of the team that safety culture has been significantly enhanced over the past two-three years at Penly NPP. However the equilibrium that has been reached seems to be rather fragile. Many different programmes are started or are planned in the near future that must take long time to be fully implemented. All personnel have not fully understood or accepted changes made, in some aspects workers seem to be just coming out of the “compliance stage” of safety culture [see INSAG 15]. Still, more efforts need to be done, in order to reach reliable sustainability of the improved situation. There is a risk for managers to become complacent over the great improvements made the last 2 -3 years, neglecting the need for continuing improvement. Therefore, the biggest challenge for the plant management at this stage is to maintain the momentum of improvement.

The team has noted a good practice in the area of enhancing safety through self assessment.

### **Other Aspects of Management of Safety**

Review of plant operational history showed that the plant experienced two safety significant events during the performance of periodic surveillance tests. Discussion with the operation staff confirmed that the potential for repetition of this kind of events still exists. Operational records indicated some non-compliance with Technical Specifications (Safety equipment unavailability, non-compliance with periodical test interval); a non-compliance with the test interval of a safety related pump was detected in the course of the mission. The safety engineer interviewed confirmed that his checking is performed on sampling basis.

The plant has already recognized the need for improvement in the course of human performance evaluation, and the team encourages implementation of the results of this effort. The team proposed a recommendation in this respect.

The plant participates in a WANO twinning program with the Novovoronezh NPP. Some extension of international contacts of department managers in specific areas could help the plant in understanding of international standards and practices and their implementation at the plant.

The advantage of a wide national nuclear programme run by a powerful corporate organization allows the plant personnel to share their ideas with peers and implement their working practices. Plant performance indicators are routinely compared to the EDF fleet indicators and the results serve to set up the new measures.

The plant established a programme for monitoring of the most sensitive parts of components from the point of view of low cycle fatigue damage. The results show that limiting elements will be able to operate with safety margins thanks to improvements in the operating procedures and in the overall improvements in conduct of operation.

The corrosion-erosion monitoring programme is being implemented. The company developed a methodology on how to deal with the issue and it covers all important aspects. Software developed on the corporate level is available at the plant to assist in performing plant specific evaluations. Geometrical data, material composition, fluid operating conditions in term of pressures, temperatures, flow rates, status water/steam, and chemistry data obtained from operation chemistry monitoring system are used. Evaluation is done by plant personnel. Contacts at the corporate level are established to compare the results, coordinate activities and enhance the overall process. Preliminary results are in good compliance with prediction.

#### 1.4. QUALITY ASSURANCE PROGRAMME

The Quality Assurance Programme includes high level documents describing the organization of the NPP and its operation. Quality manual's provisions are drawn up to obtain and guarantee the quality of important activities.

There is a wide package of documents at Penly NPP. They specify the requirements and describe the organization and management of the plant. Based on managerial levels they are focused on the plant level, department level and working team level. Finally, there are very specific documents focused on particular activities like Organizational Procedures (Instructions, Routings) and Guides (Technical Guides, Drawings, Diagrams). However, the documents belonging to the Quality Manual form only part of the whole package.

QA documents meet French nuclear legislation and company procedures of EDF. The top documents include:

- Plant management and organization
- Company policies and procedures.

They cover five main areas:

- Nuclear Safety
- Generation
- Risk prevention
- Environment
- Human Resources

An important feature of QA is a description of the main cross-company process and focus on continuous improvement. This policy is described in each area and a model of Deming Wheel is adopted (Plan, Take action, Verify and Review). To ensure that continuous improvement experience feedback is arranged, changes to requirements are followed and implemented and finally everyone can contribute to updating the documents.

QA documents address the quality related activities:

- Provided by EDF employees (operation, surveillance, audits etc.)
- Provided by contractors
- Provided by component, spare parts producer

The rules of initiation, development, updating and archiving of QA documents, are set in the document management and control system. This system is adapted to a high level of satisfaction. Description of the system is in chapter 1.6. Revisions of QA documents are performed regularly with three year intervals. A special interval of one year is set for emergency planning. Overall, the QA programme is implemented very well. In November 2004, 492 documents were approved and used to the satisfaction of personnel.

#### 1.5. INDUSTRIAL SAFETY PROGRAMME

Industrial safety is an integral part of management responsibility. Every manager is responsible for industrial safety of all subordinated personnel. The industrial safety policy is in place and well documented in plant management documentation. These documents are subject to regular review, as any other documentation. The plant performed an analysis of risk aspects related to working conditions of every position. Results are used for risk prevention and distribution of personal protective equipment.

Industrial safety objectives and goals are included in management contracts and updated every year. They are both common to the entire plant and specific to the activity of every department. Specific goals are set for annual outage activities.

Job planners perform risks analysis connected with the tasks to be performed. In the first step, the list of risks is developed. It is followed by an analysis of frequency and significance of every risk. Measures are defined to reduce the overall risk associated with the job by the means of reduction of risk frequency and reduction of significance of the risk. The feedback is arranged in every phase of activity in preparation, realisation and evaluation. Specialists in industrial safety are available to provide assistance to each department in managing the industrial safety risk. Results and measures implemented are communicated to the workers during pre-job briefings. Post-job briefing comments are used in the experience feedback loop.

Initial and continuous industrial safety training is provided to all personnel. Every employee is trained in risk prevention and refresher training is done every three years.

During the plant tour, the equipment important to industrial safety was found in good condition. The shower and eye wash stations are installed in suitable places. They are operable and regularly checked and maintained. The radiation dosimeter was marked by a periodic calibration interval. Leaking water in turbine hall was collected but some water was found in the surrounding area on the floor causing a potential for slipping.

Industrial safety indicators are used to monitor plant performance in this area. A positive trend was observed in recent years in terms of number of injuries. Data is evaluated for both plant personnel and contractors. Low-level incidents are recorded. Evaluation is performed against managerial lines of defence. This is in line with the methodology widely used at the plant. Results correlate very well with results obtained in other areas, e.g. nuclear safety.

Another type of analysis is the evaluation of barriers which prevent low level events to grow into significant injury. Both types of analysis show the room for improvement.

Plant management plays an active role in communication of industrial safety information to all personnel. Industrial safety matters are regularly discussed at meetings on all management levels. An industrial safety bulletin is issued monthly providing information on the situation and development in this area, dissemination of good practices and overall industrial safety awareness improvement e.g. encouragement of reporting of industrial safety relevant issues.

## 1.6. DOCUMENT AND RECORDS MANAGEMENT

The Quality Manual contains procedures for development, approval and maintenance of all kinds of documents. Special check points are established in every step of the process with the aim to ensure high quality of the product. Responsibility for every step of the process is defined. Technical or specialist related responsibility is borne by the originator of the document. Correctness and adherence to the other plant documents is checked by the departments, which are involved in the activity. Formal aspects of each document are checked by a documentation specialist independent of the originator of the document. The document identification system is established and used when issuing the new document. Documents are reviewed and approved before issue and use. The process is formalised and all steps are documented on the cover sheet for each document.

High attention is given to the system of distribution of documents inside and outside the plant and to the control of documents in satellite archives. A list of documents in the particular archive exists and a person is assigned to ensure the compliance of the actual content of the



archive with the list. This system ensures that new versions of each document are delivered to all users. The old documents are withdrawn when the new version of the document is issued. This excludes the use of invalid documents. A detailed scheme is applied for issue and archiving of operating procedures. Special attention is paid to the procedures designated for surveillance of items important to safety.

There exists a database management tool to support all activities connected with plant documentation. This system allows mutual exchange of information with all the plants within the fleet. The number of hard copy documents is decreasing (thanks to the availability and use of electronic versions). The high level of the documentation system and work was recently confirmed by the ISO 9001 certificate.

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

The team concluded that Penly management has taken an excellent approach to analyzing the human performance needs of the plant. The plant initiative for management presence in the field, focusing on defense in depth, should prove to be very effective in identifying weak areas for improvement. The gradual implementation of human performance tools is an excellent approach for coaching and building teamwork between supervisors and workers.

The team concluded that full integration of human performance tools across the entire site will be extremely beneficial in the long term. The plants ability to reduce risks will be greatly enhanced through the use of human performance tools. The plant and senior management are encouraged to support the human performance initiatives already being implemented.

## DETAILED MANAGEMENT, ORGANIZATION AND ADMINISTRATION FINDINGS

### 1.1. ORGANIZATION AND ADMINISTRATION

#### 1.1(a) **Good practice:** Competence Mapping System as a tool to solve the retiring personnel issue and future staffing needs.

The national and local programme of replacement of retiring personnel ensures availability of knowledge with the long-term view (up to 2022), by defining the recruitment and training programme.

The significant number of staff reaching retirement over the coming years is being addressed proactively through the setting up of a skills renewal programme. This project is coordinated by corporate management from the Nuclear Operations Division of EDF.

To illustrate the problem, half of the plant personnel will be taking retirement over the next 10 years. The strengths of this programme are:

1. An overview of crafts and how they are changing encompasses the strategic view of corporate management and the experience of plant management.
2. The programme for forecasting succession management structured at three levels – corporate, plant and craft – with coordination between them. This initiative enables the flow of personnel to be proactively forecasted (recruitment, reallocation, etc.) as a way of covering for future retirement.
3. Skills mapping for each craft at plant level:
  - To visualize available skills and any changes over time
  - To decide on actions to be taken in the area of skills and resource management (training courses, shadow training, induction of newcomers)
4. Through developing complementary action plans for addressing transfer of knowledge, based around four points:
  - Integrating newcomers
  - Craft-specific initial training
  - Shadow training in the workplace
  - Know-how that is the key to performance

The programme is based on every single area of competence, how and when the change has to be organized. The date of change is estimated for every position. Lost skills and knowledge is identified. New requirements are defined assuming other factors such as development in area of safety, management improvement, company internal sources and sensitiveness of skills. Based on previous steps the recruitment and training programme is defined.



## 1.2. MANAGEMENT ACTIVITIES

**1.2(a) Good practice:** Management presence in the field as a site management method. Significant presence in the field is set as a policy of plant management with high priority.

Implementation of this policy is well documented and communicated to the plant managers on all levels and to the entire plant staff.

Management of the site is based on strong presence in the field, which has improved the plant's results significantly.

Management presence in the field is an overall initiative with formal specification, extending over time, whose goals are shared by different management levels. It has been a progressive approach and it has reached the different levels of management, right down to the work groups.

As part of this initiative, each manager carries out field tours on which a report is written up (1,000 field tours have been carried out in 2004).

The aims of field tours are to:

- encourage staff and encourage positive behaviour and good ideas
- correct any deficiencies found in the field, remind staff of plant rules and standards
- note any organisational or logistic difficulties which hamper the proper performance of activities and note the skills to be improved

Each department management holds specific meetings to examine the findings of the different managers, the deficiencies are prioritised, dealt with and classified according to organisational lines of defence.

This classification gives each department management and the site an overview of the site's strengths and weaknesses, the management's findings are compared with the causes of significant events as well as with the Regulator's findings. Analysis of these lines of defence enables the management presence in the field programme to be readjusted to focus on identified weaknesses.

Training sessions for all staff members have been carried out, bringing together the site's different work groups.

The entire site's management has received special training in the management of lines of defence, using the Paks fuel incident as an example.

The human factors committee is made up of representatives of departments from the whole site. It analyses the lines of defence found to be the weakest to better describe them and share good ideas and good practices between departments and make them more robust.

The initiative has been under way for three years and results are improving in all areas: nuclear safety, industrial safety (fewer significant incidents, no automatic reactor scrams for 2 years, fewer significant events, and successful outages).

An opinion poll conducted by the management of the corporate nuclear operations division shows that the satisfaction level of the site's staff is above the average for the sites.

### 1.3. MANAGEMENT OF SAFETY

#### 1.3(1) **Issue:** Deficiencies exist in human performance evaluation.

Although Penly safety indicators show positive trends and often better than average fleet values, there are still pending issues necessitating improvement.

The plant experienced two safety significant events during the performance of periodic tests which showed a necessity to better adapt practices to take into account the risk, potential configuration deviation, do not rely only on technical barriers and expect improper system response. Discussion with the operation staff confirmed that potential for repetition of this kind of events still exists.

Another type of significant events was related to the plant non-compliance with Technical Specifications (equipment unavailability, non-compliance with periodical test interval). Non-compliance with test interval of a safety related pump was detected during the mission.

The safety engineer interview confirmed that his checking is performed on a sampling basis and it was not clear how the integrity of the surveillance testing line of defence is ensured.

The plant already recognized the need for improvement in the course of human performance evaluation and the team encourages implementation of results of this effort.

The aim is to strengthen the first level of Defense in Depth – Prevention of abnormal operation and failures. Examples of potential measures used within the industry include self-checking, double-checking, oversight, independent verification.

Human performance tools such as 3-way communications, repeat backs, peer checking, are not evident in the control room, simulator and field. [See Operations issue 3.5(1) and Operating Experience issue 6.1(1)].

Without these measures, a potential for safety significant events related to human performance exists.

**Recommendation:** The plant should enhance human performance evaluation. This principle should be adopted especially in relation to safety related equipment and equipment important to plant capability.

**Basis:** IAEA Safety Standards NS-G-2.4, sec. 3.15, 6.42 and Industry Best Practice

#### **Plant response/action:**

In order to perfect its existing human performance assessment programme, the site's starting point has been to analyse the line-of-defence chart.

This chart lists information collected from field inspections (1600 field inspections conducted in 2005 resulted in more than 7000 reported items), low-level events detected by the quality department, and a review of local and significant events.

The impact study with regard to lines of defence is carried out at department level as well as at plant level by the senior management team and the human and organisational performance committee (CPOH).

Human performance is assessed by trending line of defence #16 (800 findings ; trend 2004/2005 : + 430 findings) - activities are performed with the requisite level of skill and professionalism - including the use of tools such as pre-job briefings, STAR, three-way communication, as well as line of defence #17 (260 findings ; trend 2004/2005 : + 145 findings) specific to checks.

On the basis of our diagnosis, we have identified two priorities:

✓ **Focusing management presence in the field on areas where Penly needs to improve:**

In 2005, quality-related refresher training (RQ6) provided to team leaders and support staff (54 people) was based on the discussion of observation practices.

A guideline for conducting field inspections and a handbook for the observation of risk assessments during the work planning phase were drawn up in order to facilitate line-of-defence assessment.

✓ **Gradual development of human performance tools:**

Six human performance tools have been adopted by the site:

Pre-job briefing,

pause,

self-checking,

cross-checking,

three-way communication and

job debriefs.

Pre-job briefings, which are already being used on the site, will be tailored for use by the I&C department with the implementation of a reverse pre-job briefing initially intended for work on safety-related equipment.

In the area of operations, pre-job briefings are conducted by shift supervisors for activities thought to constitute a reactor trip risk, emphasising the importance of self-checking by control-room operators. The operations department has incorporated professional enhancement training in the use of human performance tools into its full-scope simulator training programme. In order to improve work planning, a trial simulator training course focusing on the operations/maintenance/I&C interface was conducted in 2005. The purpose of this course is to provide an understanding of cross-functional risk assessments between the two departments. Results have been positive and teams are being given the opportunity to attend the course as part of their 'open choice' training sessions. in 2006. This will enable us to continue with the trial in order to extend this training to all operations and I&C crews.

More widespread use of human performance tools is one of the courses of action included in the site's 2006 / 2010 strategic plan. Use of these tools will be observed by managers on the occasion of field inspections.

**IAEA Comments:**

Penly management did a very good job analyzing this issue, focusing on observed performance in the field and training needed. The human performance tools identified

through Penly's diagnosis should form a good basis for future improvements in work planning and control and error reduction methods. The team was impressed with initiative of integrating management presence in the field with the identified human performance tools. The plant is encouraged to continue with their plans to use more widespread human performance tools, especially for those tasks requiring cross-cutting activities with other departments.

**Conclusion: Satisfactory progress to date.**

**1.3(a) Good practice:** Enhancement of safety through self-assessment and teamwork.

Penly NPP has developed periodic reviews of its performance in the area of safety at each managerial level.

With regards to plant senior management, the review focuses on plant performance and trends. It also benchmarks performance with other EDF sites.

Thanks to the review process, the plant senior management team shares a common view and management priorities. Consequently, further to these reviews, plant management sets 4 or 5 priority areas for the plant for the following year.

The reviews are deployed in every department while taking into account aspects specific to each area of concern and they result in improvement action plans. At department level, this process includes the department manager, team managers and sometimes workers. Human factors are also taken into account. Management field inspection reports are analysed to identify trends, which lead to the main vulnerable areas.

At team level, general training sessions are held every year, bringing together the teams of different departments in order to analyse weaknesses and define future actions for each one of them.

In 2003 the topic was housekeeping and material condition. These sessions have been effective in implementing common plant standards regarding housekeeping.

In 2004 the subject was organisational lines of defence. It helped to finalise the plant safety policy. Many aspects of this policy have been suggested by the teams themselves.

A training project is currently being prepared for 2005. It will include some comments and proposals to reinforce the most vulnerable lines of defence.

Training initiatives for plant managers have been developed for that purpose: two training days on housekeeping in 2003, a one-day training session on lines of defence in 2004 and in 2005, a planned training session on exchanging experience from presence in the field.

This comprehensive initiative provides the whole plant with a common perception of safety and progress objectives. It is also based on a common language regarding site priorities and provides some perspective on safety management whilst giving some freedom to individual teams and departments for their own actions.

The plant manager and his management team attend each training day when all teams work together. This presence helps them to better understand the plant and to focus on the importance of safety at the plant, as well as to maintain dialogue with plant workers.

The initiative given to departments enables them to put forward innovative actions. A benchmarking exercise is done every year so that the various departments can share best practices and make progress together.

“Safety forums” are also organised, during which work teams present their innovations on a display stand.

Since the introduction of this initiative, overall plant performance has improved.

## 2. TRAINING AND QUALIFICATIONS

### 2.1. ORGANIZATION AND FUNCTIONS

The collective competence at Penly Nuclear Power Plant is high. The staff appears well trained and experienced. There is a good mixture of different levels of experience among the personnel. Management involvement in training and their dedication to develop systematic programmes to maintain and enlarge competence is clearly visible throughout the organization.

Training has been defined as one of the top priorities at the plant. Extensive programmes have been launched in all departments in the last two years to improve training. Programmes developed on local level are well adapted to corporate training programmes. Communication between EDF corporate level, local departments at the plant and training department at Penly is well structured and documented.

A functional computerized tool has been implemented to visualize and follow up the progress of each department in developing new training programmes. In aggregated form the tool gives a good overview over plant progress. Departments, which have made good progress, serve as good examples in support for others.

Managers at Penly take an active part in defining the competence needed for different groups of vocational fields. In all fields the present competence is analyzed and defined for each individual. Plans for development of competence and future development plans are discussed in close cooperation between the employee and his manager and finalized as a contract. Long-term training plans are defined and organized. The team considers this system being a good performance.

The overall structure of EDF training programmes is based on analysis of competences to be compared with the structure based on job and tasks analysis recommended by IAEA (TR 380). The EDF structure utilized at Penly provides a systematic approach to training. However traceability in the logical progression from the identification of competencies, implementation of training, to achieve identified competencies is not completely obvious.

Maintenance of training programmes, training and training material due to findings of new training needs, experience feedback and modifications at the plant are well documented and organized. Launching of new version is well documented and prepared before taken into training production.

The anticipated increase of staff turnover within EDF due to retirements and medical reasons is well analyzed. The need of a systematic programme for the transfer of competence from experienced personnel to new inexperienced personnel is detected. Such programme is implemented in most departments at Penly.

The programme named “Shadow Training” is based on a number of experienced personnel with a genuine interest for training and a desire to transfer his own competence to new employed personnel. The programme is well structured, analyzed and documented. Competences needed for each job are detected, documented by the tutor and approved by department management. On the job training under guidance and supervision of a tutor is mixed with theoretical training sessions. After training, each area of competence is validated

by the tutor and assessed by the manager. The team considers the shadow training programme and the way it is implemented at the plant as good performance.

Long-term development plans developed in close cooperation with other departments at the plant guarantee continuous recruitment of new instructors and also provide a knowledge transfer within the organization. A large number of the management has, as an example, previous experience as instructors.

Instructors possess good plant and technical knowledge and are generally well trained for their tasks. EDF has on corporate level well-developed training programmes for different areas of training activities. The training programme for instructors reflects the different fields of competence needed. Instructors are annually retrained in training methodology and teaching skills. Simulator instructors have specific training in the area of simulator training and handling the simulator. However supervisors within the Shadow Training programme are not trained teaching skills and training methodology. The team has recommended that supervisors should have basic teaching skills before they become supervisors in shadow training.

Instructors are also actively working at the plant during outage periods. This is a good system that provides instructors opportunities to maintain and enhance their knowledge and keep up with changes at the plant. The team recognized this as a good performance.

Contractors are certified at corporate level. The competence needed and training of contractors to be able to fulfill their commitments is specified and stays within the responsibility of the contractor. However specific training is not given in plant specific safety information and regulations for areas such as local radiation protection rules, fire protection, gathering points, etc. The team has suggested that contractors should have plant specific training before entrance permission to the plant.

## 2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

Training facilities at Penly NPP are good. Classrooms are all well equipped and supplied with necessary teaching tools to support a learning environment with high quality. The simulator facilities with a new full scope simulator, thermo hydraulic simulator SIPACT and facilities for emergency exercises meet good international standards.

The new full scope simulator has what it appears good fidelity; deviations from the reference power plant are well documented. The simulator is equipped with facilities for recording trainee actions and behavior.

However training material used at the training center and during shadow training does not meet the best international standards. A predominant part of training material used is slides developed by each instructor or tutor without common guidelines and pedagogical standards. The absence of standards has caused a varying quality of the material being presented to the trainees. Due to the lack of strict guidance the material more often reflects the skills of the instructor/tutor developing the material. The team has recommended development of guidelines in training material development to ensure quality and effectiveness in training.



### 2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

The training programme for control room operators, shift supervisors and shift managers is well documented and structured. Initial training programme is developed at corporate level and based on systematic analysis of competences needed for each position. The training programme is a combination of theoretical training in classrooms, simulator training and on the job training under supervision of experienced operators. All training is periodically evaluated and assessed.

The career of an operator up to the level of shift supervisor always starts from the level of field operators and subsequently step-by-step proceed to upper work positions with training in between. This model provides operators good possibilities to gradually increase their competence. Staff members could in some cases be assigned directly to the shift manager position his position after a completion of the operator and manager training programme.

The retraining programme for operators is analyzed and designed to approximately 80 % by the corporate level within EDF. The remaining part is locally developed and to some extent dedicated to each shift teams expressed training need.

Simulator retraining sessions follow prepared cases. A typical training at the simulator is three hours of simulator training follow by three hours of debriefing and follow up. During the simulator session the instructors observe, document and record the performance of the shift team in a well-structured model. Collected data are used in debriefing sessions. If any deviation from accepted behavior is detected recommended improvements are discussed within the team and implemented in the next training session. The shift manager supervises the corrective training.

A programme for assessment of shift personnel in the simulator has been developed, validated and will be implemented in 2005.

The new full scope simulator has given possibilities to increase the use of simulator training in the near future.

### 2.4. FIELD OPERATORS

The training programme of field operators is well documented and structured. Initial training programme is developed at corporate level within EDF and based on systematic analysis of competences needed.

The training programme is a combination of theoretical training in classrooms and on the job training under supervision of experienced operators. All training is well documented, evaluated and assessed.

### 2.5. MAINTENANCE PERSONNEL

Training programmes are developed from corporate training requirements and contain local elements.

Competences needed for each area within different maintenance departments is detected, documented and approved by department managers. In all areas present and future competence is analyzed and defined for each individual. This gap analysis creates a



foundation for the managers to identify and take action to develop relevant training programmes.

Training is performed in off-site and on-site facilities. Shadow training is implemented to varying extent. The I&C department is a leader in implementing shadow training and serves as a good example for other departments.

All training is evaluated and assessed by the management. Evaluations of employees are mainly made in on the job situations.

The Electro-mechanical department has developed a basic training programme for training of mechanics. The programme aims in the first place to train personnel from other areas within EDF with non-nuclear experience into maintenance positions. The programme is based on shadow training.

Some areas of maintenance have been outsourced to contractors. Each contractor is certified at corporate level. The competence needed and training of contractors is specified and stays within the responsibility of the contractor.

## 2.6. TECHNICAL SUPPORT PERSONNEL (INCLUDES TECHNICAL SUPPORT, CHEMISTRY, AND RADIATION PROTECTION PERSONNEL)

Training programmes are developed from corporate training requirements and contain local elements. Shadow training is locally used for competence transfer from experienced to newly recruited personnel.

Competences needed for each area within different departments are detected, documented and approved by department managers. In all areas present and future competence is analyzed and defined for each individual. This gap analysis creates a foundation for the managers to identify and take action to develop relevant training programmes.

To enhance competence and skills in emergency scenarios on call engineers (safety engineers) are given a significant part of the operator training programme. The engineers are retrained three days annually in the simulator.

Bilateral contacts with similar departments at other NPPs create a possibility to benchmark activities in order to enhance competence. Other actions taken to broaden competence are switching positions frequently within a group where it is possible.

All training is evaluated and assessed by management. Evaluations of employees are mainly made in on the job situations.

## 2.7. MANAGEMENT PERSONNEL

Training programmes are developed from corporate training requirements with reference to INSAG 13. The training programmes contain various forms of training in different management skills.

Programme for local support in management is developed for first line managers. Training in the form of seminars is developed to enhance company culture.

A well structured network with specific rules has been set up to give team managers the opportunity to discuss management topics and learn for more experienced colleagues. Senior management can be invited to the group to benefit from their experience.

## 2.8. GENERAL EMPLOYEE TRAINING

Training programmes are developed from corporate training requirements. The training programme appears to be well structured and organized.

The initial course in nuclear safety and quality assurance is given to all personnel. Personnel working in radiation-controlled area will have additional training in radiation protection and risk prevention.

### **PENLY FOLLOW-UP SELF ASSESSMENT**

The OSART mission was of benefit to the training and qualification area for two main reasons:

#### **1. It helped us to reinforce our expectations and rigour in the area of training**

- ✓ Prior to the mission, we were only partially certain that every worker was familiar with the basic rules of industrial safety, nuclear safety and radiation protection. By addressing the OSART suggestion, we were able to ensure that all plant workers – and not only contractors working on the plant during outage - were familiar with the rules.
- ✓ Expectations regarding department implementation of training files are now established. Two standard outlines have been drawn up for training specifications, instructor training files and slides.

#### **2. It helped us to meet needs and proactively deal with new expectations**

- ✓ The recommendation on tutor skills helped us to make early preparations for the implementation of company agreements dated 24-02-06, following on from the French law passed on 04-05-04 on life-long professional training. These agreements call for tutors to be trained before they undertake tutoring assignments.
- ✓ The DPN human resources division is waiting for feedback from this training before extended it to other plants.
- ✓ Training geared towards tutors and shadow trainers is now permanently entrenched.

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

In the area of Training and Qualification the OSART made two recommendations and one suggestion, all of which were either resolved or satisfactory progressing to date during the follow-up visit.. The team concluded that the training department and the plant worked well together to establish good action plans to address all issues. The work done to establish good guidance and training for tutors was well received and appears to becoming effective. The plant is encouraged to continue their efforts in this area and couple the results with their efforts in human performance improvements.

The plant has addressed the issue of ensuring all contractors and other EDF staff requiring unescorted access receive the proper indoctrination. New posters and handouts were developed to aid training, along with a required test to ensure knowledge retention of industrial safety issues and rules.

The training department did a very good job of developing clear guidance for the development of training material to good pedagogical practices. The team concluded that this issue is resolved for all newly developed training files and slide outlines, and resolved very well using sound training methodology. The plant is encouraged to either phase out obsolete training files or put in the newly developed format.

Overall, the issues in the area of Training and Qualification were well analyzed with appropriate well thought out action plans for long term improvements foreseen.

## DETAILED TRAINING AND QUALIFICATION FINDINGS

### 2.1. ORGANIZATION AND FUNCTIONS

**2.1(1) Issue:** There is insufficient training of supervisors/tutors of shadow training in training methodology and tutorial skills.

- Pedagogical training and guidance for the tutor/supervisor of “Shadow- training” is missing.

Without sufficient supervisor/tutor training, instruction of students could be ineffective and cause negative training results.

**Recommendation:** The plant should establish guidance in tutorial skills and training methodology for supervisors/tutors conducting shadow training to ensure good pedagogical practice. This guidance should ensure quality and effectiveness in the learning process.

**Basis:** IAEA Safety Standard ref. NS-G-2.8; sec. 5.31, 5.32

#### **Plant response/action:**

The site has a **reference document** where it sets out its expectations with regard to shadow training. This document can be accessed via the GED database and is used by plant departments.

The document was drawn up by the skills project manager in liaison with department training representatives. It defines the roles of trainees, shadow trainers, tutors and managers, and describes each stage of professional enhancement training.

Sessions were conducted by the skills project manager in order to raise the awareness of the key participants:

- ✓ Training representatives at the network meeting of 16-02-06.
- ✓ Plant senior management team on 06-03-06.
- ✓ Team leader network on 14/03/06

**A professional enhancement campaign** geared at coaches and in line with the site reference standard was initiated in February 2006. This initiative is headed up by a competent instructor (professional training department - section in charge of human resources and systems). It comprises three phases:

1. An initial interview phase took place on the 15<sup>th</sup> and 16<sup>th</sup> of February between the instructor and 8 future tutors and young trainees. These interviews provided an opportunity for conducting a full status check and honing content prior to the start of training.
2. A training phase based on an exchange of experience and on the consultant’s input will take place on 10 & 11 April and 12 May 2006, with 8 staff members. During this two-phase training course, the instructor and the trainees will review concrete implementation of skills acquired during the first phase.

3. This professional enhancement training initiative includes tutor network oversight. The instructor will come to the site on a regular basis in order to oversee the tutor network. On this occasion, the latter will share information on their tutoring experiences and practices. Two dates have been set: 13-06-06 and 26-09-06. The opportunity for trainees and instructor to communicate by phone has also been written into training specifications.

This training initiative is intended for implementation on a long-term basis and may be implemented whenever necessary. The framework letter outlining the plant's training plan for 2007 mentions the need to roll out this training within the departments.

**IAEA Comments:**

The plant departments and the training department have taken a good initiative to establish guidance in tutorial skills and training methodology for supervisors/tutors conducting shadow training. This guidance should ensure that the quality and effectiveness of the training given is consistent and at a high level to enforce that the learning process is firmly established. Although shadow training was being conducted prior to the OSART mission, it was not formalized. Tutors now feel more confident and believe they are now being properly recognized for their efforts. To follow-up on the effectiveness of this effort the plant is encouraged to integrate the results of shadow training with the human performance tools already established.

**Conclusion: Satisfactory progress to date.**

**2.1(2) Issue:** Insufficient training is given to contractors at entrance to the plant.

- Contractors nationally qualified by EDF are not given plant specific safety training regarding regulations in areas such as local radioprotection rules, fire protection, gathering points etc.
- During outage period contractors are trained, however, not all contractors may receive this training.

Without sufficient plant specific safety training, contractors may have insufficient knowledge of important plant specific regulations and personal safety actions.

**Suggestion:** Consideration should be given to develop plant specific training to contractors at entrance to the plant.

**Basis:** IAEA Safety Standard ref. NS-G-2.8

**Plant response/action:**

**Project background:** The project was set up in mid-2005 (decision taken by plant senior management team on 05-07-05). It focuses on the information provided to personnel coming to work on the site.

The project started with a clarification of expectations for the various types of incoming staff (technical, non-technical, etc.) and was approved by plant senior management on 14-11-05. It was decided to second a site engineer to the project for the period spanning December 2005 to June 2006.

**Project content:** Any person having to move around or work on the site in an independent and responsible manner will be issued with indispensable information on the subjects of nuclear safety, industrial safety, fire protection and the environment.

Prior to being issued with an access badge, every contractor (outage or otherwise) and EDF employee from another site will go through the following preliminary induction formalities:

- ✓ Viewing of a film on Penly NPP rules and regulations, on the need to maintain a constantly questioning and cautious attitude, on plant housekeeping, on ISO14001 certification, on industrial safety, on fire protection and on emergency planning & preparedness.
- ✓ Additional information provided on posters and signs.
- ✓ Essential information reiterated in a leaflet.
- ✓ A test will be conducted to ascertain understanding of these instructions.

Depending on the qualifications held by the person coming on to the site, as well as their type of work, additional tests will be taken in the areas of industrial safety & radiation protection, nuclear safety and the environment.

Long-term contractors will go through these formalities once a year.

**Project implementation:** The complete process will be up and running by June 2006:

- ✓ Process approved by plant senior management in December 2005
- ✓ Setting up of dedicated rooms: March - April
- ✓ Production of film by the communication department: April - May
- ✓ Production of instruction leaflet: to be printed in April.

✓ Internal restructuring of site logistics department to accommodate induction and test formalities: March to May

**IAEA Comments:**

The plant has taken a very good initiative to develop a project to ensure that all staff and contractors are properly trained and educated on plant rules and expectations before they are allowed on site. This effort is of particular importance before unescorted access is granted. The decision to second a site engineer to the project further guaranteed that the required training will be developed and given to the right classification of people. Although the project is in its early stages, there appear to be sound elements to ensure its success. Again, the plant is encouraged to couple their efforts in this area with newly developed human performance tools.

**Conclusion: Satisfactory progress to date.**

## 2.2 TRAINING FACILITIES, EQUIPMENT AND MATERIAL

**2.2(1) Issue:** There is no clear guidance for the development of training material to ensure good pedagogical practice.

- Training material does not meet the best pedagogical and international standards within nuclear training, especially not the visibility in slides.
- Each instructor develops training material due to his/her own skills in training material production.
- There are examples of inconsistent information in training material on safety issues.

Without clear guidance on development of training material the learning process could be ineffective and cause negative training results.

**Recommendation:** Guidelines should be established for the development of training material to ensure good pedagogical practice. This guidance should ensure quality and effectiveness in the learning process.

**Basis:** IAEA Safety Standards NS-G-2.8; sec. 6.1

### **Plant response/action:**

- All training files produced and implemented by the professional training department meet:
  - ✓ The ISO 9001 standard, which defines the QA process pertaining to document formatting rules
    - ✓ AFNOR NF X50-751 standards on training quality
    - ✓ Standards defined in the EDF-GDF document "Training process quality".
  - 1. **Standard outline models have been in place since mid-2005** (package specifications, instructor training files, trainee files, slides) and are used by instructors for all new training actions.
  - 2. **New training files meet these standards** and have been integrated into the corporate digital library.
- In addition, some courses are provided within the craft departments themselves. For these courses, the site has taken measures in order to:
  1. Ensure that the monitoring of training file quality is transferred to the professional training department. Example: The training file on EPP procedures for maintenance workers (code P232) was transferred to the training department in December 2005.
  2. Discontinue internal instructor training files and replace them with corporate SFP training wherever possible. Example: Electro-mechanical department training courses leading to MTE qualifications (H, B & M) will be discontinued as of 2007 and be replaced by a corporate SFP training course (code 035M) and additional shadow training.



3. Discontinue instructor training files found to have no additional benefits, and replace them with shadow-training actions: Example: Reactivity balance training for the quality department (SEQ) - code P345 - has been discontinued and incorporated into craft shadow training.
4. ensure that training files and associated training equipment for the remaining crafts (under 5%) remains of a high standard:
  - ✓ Since the start of 2005, all training specifications for these courses have been submitted to the training department manager for technical review. He reviews the quality-related aspects of the described needs, as well as related training objectives.
  - ✓ A standard instructor training file outline has been drawn up by the training department. This outline is available in Word format for use by occasional instructors while instructor training files are being drawn up.
  - ✓ A standard slide outline has been produced by the training department. This outline is available in PowerPoint format for use by occasional instructors while instructor training files are being drawn up.

#### **IAEA Comments:**

Since mid-2005 the plant has developed an effective process to ensure good pedagogical practice for all training materials. The team concluded that the results of this effort will further enhance the quality and consistency of training materials. Standardizing the training files in the training department and/or EDF corporate training files should improve their use and ultimately improve the outcome of the training given. This effort was particularly important for harmonizing the approach for developing training material. The issue is resolved for all new training files. The plant and training department are encouraged to complete the development of existing training files.

**Conclusions: Issue resolved.**

### 3. OPERATIONS

#### 3.1. ORGANIZATION AND FUNCTIONS

The operation department is managed and staffed by well-qualified engineers, professionals and technicians. The Operations management and staff demonstrated clear understanding of structure, roles, and mission of the department. The department is logically laid out and established to maintain Operations as the leader of site. Personnel goals and objectives are detailed via annual contracts. Site and department objectives are tracked via charts, which are posted in work spaces. The Operations department has fully embraced the management presence “in the field” programme and it is resulting in improved performance. The team recognizes the activity as a good practice and is described in the section 1.

The organization has policies for standard conduct of operation. In addition there are simplified reference quality standards developed for Operations. These quality standards provide the standards and expectations for Operations personnel. The standards address, housekeeping for the plant, procedure compliance, operator rounds, surveillance testing, etc. These are 1-2 page documents. Each Manager/Supervisor recognized Operations must lead site and keep site maintaining an operational focus. Each manager is committed to nuclear safety. This was demonstrated to questions/scenarios posed relative to maintenance and testing of safety equipment. The department has also created a “Operations Service Forum” which the team recognizes as a good practice.

The operations department for Penly NPP has adequate staff. Six shift teams per twin-unit are responsible for real-time operation. Each shift team has 1 shift operation manager, 2 shift supervisors, 2 tagging supervisors, at least 4 control room operators and 10 field staff (field technicians and field operators). The shift schedule is a rolling schedule designed so as not to have more than three night shifts in row, including training and vacation time. The shift teams receive retraining (classroom and simulator) as part of their regular shift schedules. Off shift operators receive specific requalification training prior to returning to shift work.

The role of the off-shift organization structure is to support the on-shift structure in the areas of expert appraisal and operator experience feedback, coordination of short shut-downs, planning and coordination of refueling outages, planning, work management of online activities, online procedures. The off-shift organization is divided into three groups: Power Generation Team, Methods Branch and Outage . The PGT contains members seconded from other work groups to support schedule development and work implementation. Operations has individuals seconded to outage planning, training, asset material condition.

The cross-functional “Power Generation Project” is partly staffed by members of the Operations department, but also includes personnel from the Coordination department, the Safety and Quality Advisory Unit, Chemistry, Mechanical Maintenance, I and C and Electrical maintenance, Industrial Safety, Radiation Protection, Nuclear Logistics and the Modifications team. This team produces the weekly and daily schedules which provide a graphical time plan which provides the control room with information on activities such as surveillance tests and other significant occurrences scheduled during the shift. Another important cross-functional team is that of the “Outage Project”. This team is responsible for scheduling and planning outages on all units.

The Operations staff relies on a call out system for support on off hours. The Shift Supervisors are backed up by the Shift Manager in the control room during events. The

control room staff is backed up by senior management and senior Operations personnel which respond on an on call basis. The annual contracts with the staff and shift teams are detailed and comprehensive. It was noted during the observation period that the day shift control operators were challenged to conduct control board monitoring. The team made a suggestion in this area.

### 3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

Each unit has a main control room and emergency shutdown panel. They are well equipped, well located and use displays which include mimics and annunciator alarm panels. The control room lighting, layout and furniture adequately support the operators. Access is well controlled. Procedures and equipment for normal and emergency activities were accessible to the operating crew. The department has established a weekly review by the shift manager of all alarms on the unit. The team recognizes this as a good practice.

The control room uses conventional phones, pagers, and a Plant Announcement system. A mini cell phone system is used by operations during outages. It was noted by the team that mini cell phones are located on the horizontal part of the control board on both units and a regular phone is on the control board. The team suggests that the plant consider removal of the phones to reduce the possibility of a dropped phone causing a problem on the control board.

The operations department is overseeing the introduction of a plant-wide sign system, designed to make access and maintenance work easier. The team recognized this as a good practice.

Line-ups and tag outs for work or for other reasons are well managed and controlled by the tagging supervisor with support from the shift-team and Power Operations Project. In an effort to continue enhancement of the site housekeeping and material condition an off shift SS has been given the task to lead the site housekeeping/material condition inspection programme. Significant improvement has been noted, but continued effort is needed to bring the plant to the desired standards.

### 3.3. OPERATING RULES AND PROCEDURES

The operating rules are presented in technical specifications for operation, incident and accident procedures, monitoring and surveillance test programmes for equipment and safety related programmes. Main operation procedures are developed based on the technical specification limits. Surveillance programmes are documented and all information analyzed by the operations department. Limiting Conditions of Operations (LCOs) for equipment and systems is clearly defined and tracked by the shift crew in the operating log and displayed on a white board at the entrance to the control room. The LCOs are also reviewed at the 08:15 Operations review meeting. The department schedules, tracks, and dispositions the performance of all surveillances.

The department has developed a procedure documenting all outage surveillances deviations and the dispositions of each deviation. The team recognizes this as a good practice.

Operating procedures are in good condition, clearly written, well understood and provide the necessary references. It was noted by the team that several plant operating documents have been altered through the use of white out (correction fluid) or scratch outs. The team recommends this practice be reviewed. Operators can submit procedure changes to the

Methods Group. This group evaluates reviews and implements procedure changes. Procedure changes that result from OE are submitted or identified by the Methods Group. The Methods Group has a computerized tracking system for procedure changes. The system for procedure updating works efficiently. There is a well organized system developed for operators to report all operation procedure errors. In the event of any modification to operation, a temporary operating instruction is provided to take into account any deviation from the operation document. Flow sheets and emergency procedures are encased in plastic and carry coloured information.

Emergency procedures are state based. They are of a high standard, are clearly understood and are easily accessible. When a deviation occurs, an alarm prompts operators to apply state based procedures. The procedures are logically formatted, easy to use, and are designated by watch stander position. Operators can easily and quickly find the procedures.

### 3.4. OPERATING HISTORY

*See section 6.0 of the report*

### 3.5. CONDUCT OF OPERATIONS

The control room gives the impression of professionalism. Permission was required prior to entry into the CR. Operators were attentive to the control board. Operating procedures are available in the control room and are used. Shift turnover was on station. The on coming operators received written and verbal input from the off going operators. A shift briefing for all on coming shift members was conducted and lead by the Shift Supervisor. The SS summarized the shift's priorities and activities. Each team member provided status and input. Shift turnovers of control room personnel were observed to be detailed, professional and of high quality. The briefings following the turnovers are adequate to assure the information exchange within each shift crew is of high quality. During debriefing and shift turnovers the communication pertaining to the unavailability of safety related equipment is given priority.

Both units load follow and thus make numerous power changes in support of grid demands. The frequent power changes constitute reactivity changes under the direction of the control operator. The activities are well controlled and executed. Human performance tools such as three-way communication, STAR (Stop, Think, Act, Review), self checking or peer checking are not evident in the control room, simulator or the field. The team suggests the site consider enhanced on line supervisory oversight or peer checking to further minimize the possibility a human error could result in a plant or reactivity event.

The surveillance programme adequately verifies the availability of safety equipment. Operations surveillance tests are scheduled and tracked by the organization. The test procedures are comprehensive and the acceptance criterion was clearly defined. The site has developed a surveillance test acceptance flowchart that clearly and concisely links test results to Technical Specifications requirements. The flowchart simplifies operability determinations if and when problems arise during a test. The team recognizes the flowchart and action step formatting as a good practice.

Field operator rounds are supported by special portable computers which are good tools to record, compare and submit important plant parameters. The observed rounds included a material condition inspection. Several material condition discrepancies were noted by the

operator however several others were not captured. The team suggests continued coaching by supervisors and managers to improve the observational skills of field operators. An off shift SS has been given the task to lead the site housekeeping/material condition inspection programme.

Plant configuration changes; tag outs, valve line ups, temporary modifications, maintenance activities are control by the Operations department. The Safety engineer and Shift Manager conduct the review of any off normal events or reactor scrams. The senior management of operations and the site provide oversight and review of the events.

### 3.6. WORK AUTHORIZATIONS

The plant system for work authorization is well organized. A person that detects a deficiency reports it using SYGMA, a corporate application designed for maintenance work management. There are several daily cross-site meetings, with managers involved, give a broad understanding between departments of how work is prioritised. The participation of the shift operations manager and nuclear safety engineer ensure that nuclear safety is considered.

The Methods Group of Operations reviews all modifications for impact to operation. They identify any required procedure changes and training. Each shift has an experienced tagging supervisor whose main responsibility is to carry out tagging activities and real-time monitoring to support the shift supervisor. Out of service equipment is discussed at turnover meetings. Inoperable safety equipment is denoted in operator logs and on the “LCO” board maintained at the entrance of each control room. The process used for control of temporary modifications and maintenance work is good.

The Operations department has established an Outage group consisting of an off shift Shift Manager and 11 other off shift personnel who are responsible for planning, facilitating, and coordinating all Operations outage activities. They also perform risk assessment of other organizations outage activities. They work with the site outage project team. The Operations Outage group has developed a detailed outage valve line up control process and flow diagram which the team recognizes as a good practice.

### 3.7. FIRE PROTECTION PROGRAMME

The Penly NPP fire protection programme follows most international industrial practices. Unit 1 is in the process of implementing a significant modification to upgrade the fire protection systems. Unit 2 completed the modification earlier this year. The fire protection systems rely on a modern fire alarm system. The new strategies developed as part of the FP modifications are excellent. The site has developed and is using fire action sheets. These are an operational tool allowing field operators involved in first response teams to perform the predefined checks and actions in case of fire. Penly has been and is color coding the fire zones by train (red and green) and color coding access ways (yellow) to aid in fire response. This will help personnel identifying fires and also evacuating a fire. The team recognizes this as a good practice.

Fire protection equipment inspected was found to be in good condition. A contract vendor inspects and maintains extinguishers and hoses. However, several sprinkler heads in unit 1 and unit 2 were found to have signs of corrosion. The team recommended improvement in the inspection of the sprinkler heads.

As part of the comprehensive FP programme upgrade local fire protection procedures are posted. Actions rely on three organizational response teams. The “first line response team”, staffed by members from the shift teams, is sent out to verify the fire location and isolate the affected fire zone. They get fire protection formal sheets (FAI) directly from the local alarm panel area. The “second line response team” then prepares for and begins fire fighting. The third team is the external fire-fighting brigade. The site has a well developed set of fire pre-plans which are used with the local fire departments. The team recognized this as a good practice. The local fire departments (third team) participate in one full scale drill a year and several partial scope drills.

The site has a set of well developed and detailed preplans supporting the use of offsite fire groups. A fire drill and post job critique was observed. All parties involved in the drill participated and provide critical feedback. Several improvement items were noted by the Lead Evaluator.

### 3.8. ACCIDENT MANAGEMENT

Accident management is well organized and provides a good response. Roles and responsibilities during emergencies are clearly defined within the operations department. Normal shift compliment ensures emergency plan can be effectively implemented. Plant design minimizes need for immediate actions.

The operations staff is trained to respond to an accident during simulator training, which includes special emergency training. In an event, the shift operations manager controls operations from the local command post in the main control room. The safety engineer and shift supervisor monitor the unit from the control room. The shift operations manager, as head of the installation, communicates with plant management. Shift support for off hour’s events/problems is provided by a thorough on call programme. Senior Managers and Safety Engineers are typically on a 4 week rotation. The Safety Engineers are contacted whenever an unplanned ‘group 1’ limiting condition of operation is entered.

Operations management does not currently conduct routine observations or evaluations of shift team’s performance during training. Plans have been drafted for Operations management to perform evaluations in 2005.

### **PENLY FOLLOW-UP SELF ASSESSMENT**

The OSART mission raised our awareness of areas for improvement to be implemented so as to further enhance our safety culture. On the one hand the recommendations and suggestions; on the other the exchanges with the review teams were all very beneficial for us as well as being a source of new ideas.

The operations department decided to conduct a general investigation so as to address the suggestions and recommendations, while at the same time looking at ways in which to sustain its good practices over the long term. We did not feel that we would make collective and sustainable progress in the area of nuclear safety by dwelling on each deficiency individually.

We therefore identified a number of areas for improvement where we implemented improvement efforts:



- ✓ Better workstation ergonomics
- ✓ Minimising distractions during sensitive activities
- ✓ Improving the behaviour of department staff

These efforts are comprehensive and some actions affect a number of suggestions and recommendations.

The 'human performance' project, whose constituent parts include 'presence in the field' and 'error reduction in the workplace', has opened the way to a better understanding of changes in behaviour, which is a source for improving safety culture.

Although this effort is still in its early stages, there are already positive indications from the initial actions that reveal a determination to improve among all department staff members.

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

In the area of Operations the organization has taken a broad look of the issues identified by the OSART team in order to develop and implement actions to continue strengthening plant operations. The team concluded the actions were comprehensive and will support continued improvement of the Operations department. Three of the issues are resolved and the other three are progressing satisfactorily.

The Operations Department has and is enhancing plant safety by reducing distractions to the Control Room operators and enhancing protection of the main control board panels. Clear guidance has been provided to the operators resulting in elimination of the potential for log or procedure errors from strike outs or use of white out.

Significant improvement in the material condition of the plant was noted during plant tours by the team. This is in part due to the enhanced guidance and training provided to the field operators. The plant staff recognizes this effort is not complete and will be an ongoing focus area. The development and implementation of the six human performance tools will be beneficial to the organization. Full and consistent implementation of the tools will reduce the potential for errors. The organization is encouraged to continue the implementation of the tools.

The Operations department, site, and corporate organizations have fully identified the actions to address the fire protection issue identified by the OSART team. The evaluations, safety implications, and follow up actions were much broader and extensive than anticipated by the team. The progress being made is satisfactory and the actions are fully on track to be completed by the end of 2006 as scheduled.

## DETAILED OPERATIONS FINDINGS

### 3.1. ORGANIZATIONS AND FUNCTIONS

**3.1(1) Issue:** The control operators on dayshift are challenged to perform their control board monitoring duty due to numerous distractions.

- The Reactor Operators are tasked with administrative duties of permitting personnel into the control room and answering all calls to the control room.
- During the surveillance test (SGBD Sample valve test) the operator was distracted by several individuals requesting permission to the control room and several phone calls.
- Following the test a fire alarm came in and during the 10 minutes waiting for the field report several additional individuals requested permission to enter the control room or ask questions.
- Testing personnel entered the control room to perform their duties.
- During a fire drill personnel not associated with the drill entered the control room prompting intervention by the operators.
- Surveillance testing frequently requires one operator to leave the control room requiring the remaining operator to be the sole point of contact in the control room.

Distractions to the control operators increase the possibility that control board vigilance could be adversely affected resulting in inappropriate actions or events.

**Suggestion:** Consideration should be given to reviewing the workload and distractions for day shift control room operators on whether some support in responding to the administrative activities is warranted.

**Basis:** IAEA Safety Standards NS-G-2.4, sec. 6.14

#### **Plant response/action:**

This suggestion was issued with a view to reducing the number of disruptions to which control-room operators are subjected, particularly during normal working hours. In order for us to successfully improve operations staff's control over the plant, we feel it is important to focus our attention on quiet control-room conditions, as a priority. Indeed, investigations conducted following the OSART mission have shown that a number of disruptions could be avoided by raising our expectations as to a calm environment in the control room.

Our efforts in this area are focussing on two main aspects:

- ▶ improved signage in order to **promote a questioning attitude**
- ▶ improved **worker behaviour inside the control room** (operations and other staff)

The following decisions have been implemented:

- ✓ Placing of a clearly visible STOP sign at the control-room entrance (at the front counter). People wishing to enter the control-room or speak to a control-room



operator will wait until the control room operator is available, outside the actual control-room area.

- ✓ Installing removable barrier tape in order to bar entry. This action complements the previous one and ensures that control-room operators have full control over entry to the control room.
- ✓ Improved control-room entry signage. A sign with the words “access reserved for operations / quality departments” ensures that entry will be restricted in critical situations. Control-room operators can display this sign whenever it is warranted by the need to maintain quieter conditions inside the control-room. Furthermore, and in addition to this principle, the operations department has stipulated that during the two most sensitive phases (criticality and bubble collapse), entry to the control room is restricted to those people whose presence is absolutely necessary for performing the activity in question (shift team and safety engineer).
- ✓ Control-room reference standards revised in order to clarify signage changes, reiterate control-room operator responsibilities and thus raise standards governing quiet conditions in the control room.
- ✓ Reference standards explained to other departments (discussions with plant senior management and dialogue with crafts on the occasion of department meetings).
- ✓ Additional control-room operator stationed in control room during sensitive phases. This entails bringing in a control-room operator from the outage operations team whenever sensitive activities are performed (going onto midloop, sensitive surveillance tests, etc.). Furthermore, an operations planner, who oversees fire protection within the department, is responsible for managing hot-work permits in very busy periods (large number of maintenance outage jobs on the go, for instance).
- ✓ Stepping up presence of shift supervisors during sensitive transients. While continuing to fulfil their role of monitoring activities, they also enable control-room operators to focus on sensitive activities. Their presence is required during highly sensitive phases (criticality and bubble collapse, for instance).
- ✓ During outage, a maintenance coordinator is permanently stationed in the control room (3 x 8-hour shifts). His role is to foster discussion between the shift team and craft workers. This also minimises disruption to control-room operators.
- ✓ A review of surveillance test scheduling has resulted in the rescheduling of certain tests with a view to maximising control-room operator availability during normal working hours (thereby reducing periods of time during which their vigilance may have been affected). Some surveillance tests have now been moved from day shifts to night and weekend shifts.
- ✓ The corporate ORLI project will provide access to KIT (plant data processing system) on the site computer network. In order to access data, craft workers will no longer need to go to the control-room to consult with control room operators.

All these actions were approved by operations senior management at the department senior management meeting held on 19/09/2005. Implementation of these decisions will be monitored by conducting “control-room field inspections”, using the updated version of reference standards as a basis.

**IAEA Comments:**

The actions taken by the Operations Department fully address the issue. Control Room observations by the reviewer noted all personnel entering requested permission prior to entry and demarcation lines were painted on the floor in front of the main control board. The level of activity and distraction to the Control Operators was reduced. The additional actions of surveillance test scheduling and use of a maintenance coordinator during outages will further minimize impacts to the operators.

**Conclusion: Issue resolved.****3.1(a) Good practice: Operations Forum**

A computerised forum is providing access to the following information:

- attendance and training schedules
- work authorization tracking
- common documents (standard outlines, reference standards, etc.),
- department key performance indicators

The department training administrator suggested setting up an interface providing simple and user-friendly access to data that would be useful for staff. It facilitates sharing of common information for operations staff. It is conducive to greater thoroughness in training and qualification running. The tool can be used by management to verify completion of mandatory training courses and training surveys.

## 3.2. OPERATION FACILITIES AND OPERATOR AIDES

**3.2(1) Issue:** The control board is not protected from inadvertent contact or blockage.

- There are two site internal cellular phones mounted on the main control board horizontal panels on each Unit.
- Unit 1 also has a standard desk phone on the board by the plant computer panel. These devices are a potential drop risk on reactor controls.
- An operator was observed (at the simulator) sitting/leaning against control board wooden rail.

Loose material could be dropped or fall causing damage to the control board or unintended component operation.

**Suggestion:** The Penly NPP should consider reviewing their policy and procedures, for protecting control panels in the main control room, and implement necessary changes or controls.

**Basis:** Good international practice and IAEA Safety Standard NS-R-2 see 5.15.

### **Plant response/action:**

Control panels inside the control room must be protected from inadvertent contact by applying two basic principles:

- ▶▶ restricting the presence of **people** close to panels,
- ▶▶ restricting the presence of **objects** close to panels.

✓ With regard to the first point and in addition to limiting the number of people inside the control room (suggestion 3.1(1)), the plant has decided that an effective solution would be to use floor markings barring access to control panels, with the exception of authorised personnel (shift team and safety engineer). Rules governing this “forbidden” area are set out in the reference standard on “control-room conditions”. This action was approved by operations department management at the senior management meeting held on 19/09/2005.

✓ With regard to the second point, no equipment is allowed on control boards. The control-room reference standard sets out expectations concerning the use of objects close to the control boards.

✓ Furthermore, and in relation to an effective practice identified by the EDF Nuclear Operations Division, 9 equipment control systems (turn-push light switches) are protected by a plastic cover in order to avoid inadvertent operation. These turn-push light switches are identified as components that must not be manoeuvred during power operations. They are located close to routinely used operating components, where the risk of confusion could lead to a critical situation (potential reactor scram, for instance).

✓ All improvements made with a view to protecting the control room (suggestion 3.1(1) and 3.2(1)) have been submitted to the site senior management team in order for changes and rules to reach as large a population as possible. They have also been written up in an article and published in the site newspaper “OSART News”. This has been effective in informing all staff about changes to the control-room reference standard.

Application of the control-room reference standard and subsequent compliance with actions aimed at promoting more rigorous behaviour are monitored via the conduct of regular field inspections by department managers.

**IAEA Comments:**

The Operations Department has addressed this issue by removing the standard telephone from the control panel, permanently affixing the site internal phones to the panel, and placing protective covers over sensitive components. These actions coupled with the actions in response to issue 3.1(1) have fully resolved this issue.

**Conclusion: Issue resolved.**

### **3.2(a) Good practice: Room Identification/Sign**

The operations department is overseeing the introduction of a plant-wide sign system, designed to make access and maintenance work easier. The team recognized this as a good practice.

The plant sign system, currently being set up on units 1 and 2, meets requirements for entering the various rooms and for addressing risks associated with specific areas of the plant. Signs consist of two sections. The first section describes a floor or an area together with the respective rooms. The second section describes each room. The system is based on the following three points:

- The sign displays a simplified drawing of the room. If it describes the room, it also provides information regarding the room about to be entered (sign posted on entrance doors).
- The sign lists the main items of equipment inside the room (valves, pumps, coolers, etc.).
- The sign displays risks and protective equipment required before entering the room (sign complies with international regulations).

The system is a very easy to understand and uses visual and intuitive communication methods. They can be understood by anyone entering plant rooms (EDF staff and contractors).

These signs have provided significant added value in terms of orientation at the site. The system has also brought about improvements in terms of industrial safety: relevant risks are posted to prevent events from occurring. Lastly, in terms of shadow training, efficient signs are conducive to a quicker transfer of knowledge through a more targeted approach to rooms and equipment.

### **3.2(b) Good practice: Alarm Management**

The alarm management system provides a comprehensive and informed overview of alarms appearing in the control room.

Displayed alarms denoting a deficiency on the plant are tracked and validated, and actions requested to deal with them are monitored. A summary chart is available in the control room, providing a clear overview of the situation. This guarantees that information is conveyed to all shift crews.

Every week, an ongoing check is performed by the shift crew. This makes it possible to ascertain that the inventory documented in the tracking binder is accurate. It is also an effective means of following up on corrective actions and formalising a comprehensive safety analysis with regard to displayed alarms. In addition, a concise alarm report is included in the Weekly Operations Review and is presented at the site senior management meeting by the shift manager.

### 3.3 OPERATING RULES AND PROCEDURES

**3.3(1) Issue:** Some plant operating documents have been altered without proper administrative control.

- Noted two documents in the control room, which had white out and or line outs on them. Both (Chemistry request sheet and Nuclear Instrument Surveillance test instructions) were in use.
- The whiteout on the NI temporary instruction had hand written instructions changing the Bank R control rod position for the test. There were no initials, technical reviews, etc., of the hand written instructions.
- The Shift Manager, Shift Supervisor, control operators, and field operators, logs contained line outs and scratch outs without any initials or approval.
- Observed the ADRP and WR release log books (official records) contained white out and line outs without initial and dates.
- The Safety Engineer's data sheet contained white out.
- Operations Quality reference Standard issued in 2003 specifically delineates white out (correction fluid) is not to be used.

White out (correction fluid) and line outs/scratch outs could compromise the procedure control process resulting in unapproved documents being used to operate or control the plant.

**Recommendation:** The plant should review and enforce its administrative controls for changes to plant operating documents to ensure that all quality controls are in place.

**Basis:** IAEA Safety Standard, NS-G-2.4 Sec. 6.26 and 6.76

#### **Plant response/action:**

In order to address the issue, the operations department has **implemented a policy designed to eradicate the use of white-out and scratch-outs**. This policy is set out in site senior management decision-making report no. 10 (approved at the site senior management meeting held on 07/02/2005).

According to the decision-making report, only scratch-outs made with a single line are acceptable, together with a signature of approval and the insertion of new information.

The use of white-out is prohibited on operating documents (an error may be corrected by means of a properly executed scratch-out).

Compliant implementation of this decision is monitored by having periodic field inspections conducted by department managers. This monitoring role is explicitly stated in the individual objectives set for shift supervisors and shift managers.

In order to address one of the deficiencies identified during the review, it is worth adding that temporary operating procedures are managed by means of a computerised system. This improvement guarantees that temporary operating procedures undergo a QA process whereby handwritten changes are no longer possible.

## **IAEA Comments:**

The actions taken by the plant staff address the issue. The policy established and implemented coupled with periodic review by shift and on-call management have ended the previous practice. A review of operating logs and other Operations documents did not reveal any use of white-out or scratch-outs.

**Conclusion: Issue resolved.**

### **3.3(a) Good practice: Outage surveillance testing deviation report.**

In order to facilitate the follow-up on deviations identified during surveillance tests carried out in outage, the outage operations team (ECAT) draws up a summary report containing the analyses.

During outage surveillance tests, the ECAT carries out exhaustive monitoring of the processing of deviations detected. Each deviation is identified and analysed. To improve follow-up and foster communication on deviation processing, the ECAT has drawn up a summary report including the following information:

- Summary of deviations identified and processing carried out.
- Exhaustive analysis of deviation processing along with all documents proving QA.

This database is used by ECAT to monitor deviations and guarantee comprehensive processing. It is also used when the surveillance testing report is submitted to the regulatory authorities at the end of outage. It has been recognized and is well appreciated by the regulator. This is a tool which favours openness and thoroughness, the aim being to reduce the number of deviations identified during outage surveillance testing.

### 3.5 CONDUCT OF OPERATIONS

**3.5(1) Issue:** Human performance tools such as 3-way communications, repeat backs, peer checking, are not evident in the control room, simulator and field.

- Reactor Operator responded to annunciator as expected. But no announcement of the alarm was given or acknowledged.
- A power change (increase) was observed without peer check of the control operator's actions.
- No management standard exists for routine reactivity manipulation (load changes).
- Several other communications and alarm responses were observed in the control room. No three-way communication was used. If the operators were to use three way communications or repeat backs, this would de facto require that the plant always keep two individuals in the control room. This also gives the plant the opportunity to consider an enhancement without disturbing the staff's culture of complete trust in personnel.
- During simulator scenario no 3-way or repeat back communications were observed.
- During performance of the SGBD sample valve test the operator relied primarily on the plant design to prevent manipulation error. There was no demonstrative self check.
- A field operator was observed to manipulate four valves in radwaste system, self check was performed and two valves were open simultaneously.

Failure to utilize human error reductions tools could result in higher rates of job performance errors.

**Suggestion:** The plant should consider implementation of human performance tools for communications and peer checking to reduce the potential for errors and confusion.

**Basis:** IAEA Safety Standard, NS-G-2.4 Sec 6.2

#### **Plant response/action:**

Human error prevention tools provide an effective means of improving human performance (particularly with regard to nuclear safety). However, staff must be given support in implementing steps taken in this area, in order to ensure acceptance of new working methods. Because human performance tools mainly affect human behaviour, the approach must be participative as well as constructive.

To begin with, work needs to be done on the acceptance of these tools, their widespread implementation and their usefulness.

Two actions have been initiated:

- ✓ The first action taken by Penly NPP involves the **writing of a concise document describing the most important human performance tools**. The six tools on which the document focuses are: pre-job briefings, three-way communication, stopping to think, cross-checking, self-checking and debriefings.



The purpose of this document is for staff to familiarise themselves with error prevention tools. The contractually binding document governing the full-scope simulator training programme for 2006 (agreement between DPN-NPP and the professional training department or SFP), clearly includes professional enhancement training in the set of error reduction tools.

- ✓ The second action involves the **production of an investigative study on all risky situations** (in the control room as well as during activities such as surveillance tests or operating manoeuvres). This will serve as a basis for identifying effective barriers to ensure compliance with quality rules. Areas being explored include ergonomics, communication and reduction of situations with a risk of deviation from rules.

Secondly, the operations department has implemented **the use of “effective practices” in two key areas:**

- ✓ During refresher training sessions on simulator, the human performance tool manual is applied. In order to facilitate its acceptance, tools are presented at the beginning of the session and a summing-up session is held at the end of the training week. This document has been forwarded to SFP instructors in order to ensure consistency of messages conveyed by operations management and the training department.

- ✓ As far as field operators are concerned, an educational and user-friendly guide is being used to promote understanding of the human performance tools adopted by the NPP.

In addition, the Nuclear Operations Division (DPN) is also looking into the implementation of human performance tools as part of its “human performance project”. INPO reference standards are being used as a basis. The Penly operations department is involved in this initiative via the site’s human and organisational performance committee - COPH). The aim of this joint effort (NPP / DPN) is to make Penly a driving force behind the widespread implementation of human performance tools.

#### **IAEA Comments:**

The actions taken by the plant address the issue. The development and implementation of human performance tools document and study of risk significant evolutions will reduce the potential for human error.

The implementation of the six core human performance tools has just begun and as such positive benefits are not fully apparent. Satisfactory progress has been made in resolving this issue.

**Conclusion: Satisfactory progress to date.**

**3.5(2) Issue:** Field operators are not consistently identifying discrepant housekeeping and material conditions.

#### Turbine building unit 2

1. Elevation around degasifier 2ADG is very dark (by design). Operator had not reported.
2. From crane 2DMM105PE, oil is dropping on the floor. Small piece of paper is placed on the floor to absorb oil, so oil is spread on the paper and around the paper, over the concrete floor.
3. Water is leaking from pump 2STR002PO through the seal since 10/19/04. A work request was prepared, but there are two pumps, so it would be better start up the second pump and shut down the first. There is a large puddle of water on the floor.
4. Fire hose 2JPD741VE. After test, the floor remained wet, water is dropping from the hose, and footprints can be observed on the floor.
5. Oil leaking from the bearing of the condensate extraction pump 2CEX002PO. A work request was prepared, but the pump case remained covered by oil, and oil is dropping on the floor.

#### Pump House Unit 2, train A

1. Pipe DVP has no thermal insulation. No work request has been prepared.
2. Electric cables 2GP005A, with a piece of bread 5x5 cm and equivalent piece of aluminium foil next.
3. Instruments cabinet 2CFI153CR, steel sheet cover is open in one side, with two bolts missing. No work request has been prepared.

#### Controlled Area BAN Building, Unit 1.

1. In room ND0703, an unidentified tape 30x30 cm is closing or hiding something on the floor.
2. In room NC0701 there are foreign materials, two tubes about 3 m long and three drums with chemicals inside.
3. Phosphate powder is on the floor, next to the spray pump, train A.

Failure of the field operators to identify and report discrepant conditions could adversely impact plant operation and or industrial safety.

**Suggestion:** Consideration should be given by the plant to continue to improve the housekeeping and material condition of the plant and seize this opportunity to reinforce high standards for field operator patrols.

**Basis:** IAEA Safety Standard NS-G-2.4, para 5.17; IAEA INSAG-13 sec. 4.4.92, INSAG-15 sec. 3.5

#### **Plant response/action:**

Standards governing plant and material condition are of vital importance for field operator walkdowns. Each of the operations department's field operators are expected to be familiar with reference standards and expectations. These are an essential factor when it comes to keeping plant assets in good condition.

In order to improve consistency and quality, we regularly reinforce our expectations with regard to field operators.

In order to ensure that these expectations are met, we have done the following:

- ✓ Clarification of deficiency processing methods (using work requests or plant condition deficiency reports), with a reminder of “basic housekeeping practices” to be completed during walkdowns (monitoring signs of leakage, eliminating very small deficiencies, etc.)
- ✓ “Plant and material condition” database made accessible to all members of the operations department. This enables all staff members to classify deficiencies for optimal processing.
- ✓ On the occasion of the half-day devoted to information and exchanges between shift teams and the department manager, expectations and good practices in the area of plant and material condition will be reiterated and discussed (consistency between teams).
- ✓ Plant and material condition (EDI) training incorporated into professional enhancement training for field operators. Training day conducted by the head of the EDI team.
- ✓ Reminder of management’s key role in the monitoring of plant and material condition (individual objective of shift supervisors approved by department manager)
- ✓ The safety/quality refresher course deals with plant and material condition for all plant staff members. The plant’s EDI team organises a half-day session on this topic (with time spent in the field). This new initiative has helped to raise standards among all staff.

In order to ensure that operators understand and implement the concept of critical appraisal, our presence in the field has been bolstered and given greater support. For year 2006, our field inspection schedule has been adjusted to accommodate more time in the field for team managers (shift managers and shift supervisors). Indeed, these managers conduct one “field-type” inspection per shift week (walkdowns, line-ups, isolations). During these inspections, managers focus on how workers comply with “plant and material condition” reference standards.

#### **IAEA Comments:**

Actions taken to address this issue have been appropriate. The standards and expectations issued by Operations Department are clear to the field operators. Training is and has been provided to Operations and all plant personnel to reinforce the importance of plant and material condition.

A tour of the U1 Turbine building, U1 Pump house, U2 electrical penetration areas, and both control rooms show an improved material condition and cleanliness from the time of the mission. The site recognizes that the effort in this area is continual and will remain an area of focus and improvement.

**Conclusion: Satisfactory progress to date.**

**3.5(a) Good practice:** The site has developed a surveillance test acceptance flowchart that clearly and concisely links test results to Technical Specifications requirements. The Operations Department has developed a format for surveillance tests where the aim is to reinforce thoroughness during the actual performance phase of the activity.

Safety-related surveillance test procedures have a specific human-error reducing format and include a decision-making flowchart for the acceptance of test criteria.

This has the following benefits:

- Concisely lists safety criteria checked during the test by grouping them into two priority levels (group A and B) on the result page.
- Provides the basis for determining whether test results are satisfactory, satisfactory with reservation or not satisfactory, through use of the decision-making flowchart.
- Informs each worker of all actions completed in the test procedure.
- Different fonts are used to distinguish between the actions of each individual.

This system has the following safety benefits:

- Facilitates performance of test.
- Optimises communication between people involved.
- Comprehensive and quick analysis of test results in terms of safety consequences.

### 3.6. WORK CONTROL

**3.6(a) Good practice:** Outage valve line-up implementation monitoring guide

The Outage Operations Team (ECAT) is in charge of the smooth running of the various line-up phases in order to meet the objectives of nuclear safety (equipment availability) and efficiency (compliance with schedule). In order to facilitate this monitoring and to anticipate activities, the ECAT has produced a line-up implementation monitoring guide. It restates in an easily understandable way, the implementation link-up phases and the various line-ups to be carried out to ensure equipment availability as soon as possible. This guide is used by the ECAT for monitoring and by the shift teams to better understand the sequencing of the various activity packages that are required of them.

This guide enables the nuclear safety to be enhanced in the field of line-ups thanks to the visual monitoring that it allows. Communication on the current status of line-ups is thus facilitated. The original inspiration for this document came from the field operators seconded to the outage structure.

### 3.7. FIRE PROTECTION PROGRAMME

**3.7(1) Issue:** The inspection programme for mitigation systems is not sufficiently robust to ensure the systems will adequately perform their intended function.

- 10 sprinkler heads in the Unit 1 cable spread rooms/vaults showed corrosion which may affect operation
- 5 penetrations in the Unit 1 cable spread room/vaults did not have all the fire barrier material in place
- 1 sprinkler head on Unit 2 showed signs of corrosion
- Three of 20 Unit 2 penetrations showed sealing bags out of place

Inoperable sprinkler heads and inadequate fire barrier reduce the effectiveness of the Fire Protection systems ability to mitigate a fire event which could jeopardize plant operations and response.

**Recommendation:** The fire protection system inspection process should be enhanced to identify and correct fire protection equipment such as sprinkler heads.

**Basis:** IAEA Safety Standard Series NS-G-2.1, NS-G-2.4 Sec. 6.59

#### **Plant response/action:**

##### *Sprinklers*

As a result of the various instances of corrosion found on sprinklers during the OSART mission, we immediately set up a **programme to check and replace defective equipment throughout the plant**. In total, 135 sprinklers were replaced in December 2004 and January 2005.

At the same time, we issued a fast-track OE report and got in touch with the corporate engineering entities in order to devise a method for drawing up a preventive maintenance programme suited to our facilities and in line with the various practices adopted by suppliers and insurance companies.

The maintenance group attached to the nuclear operations support centre (CAPE) then issued a report based on the APSAD R1 rule, recommending a number of points to be included in a monitoring and maintenance programme for this type of equipment:

- ✓ Regular checks during operations rounds
- ✓ In-depth annual checking during surveillance tests
- ✓ Condition-based maintenance in the event of significant corrosion
- ✓ Draining, flushing and drying of lines after filling them with water
- ✓ Checking of low parts of lines every 10 years
- ✓ Sample tests every 30 years

The action plan currently being implemented in order to apply these recommendations is being overseen by the plant's engineering department. It relies heavily on support from the electromechanical and operations departments.

Regular checks during operations rounds forms part of general plant monitoring activities carried out by operations staff. When the OSART results were presented to staff, the opportunity was used to go through points to be observed, in particular sprinkler condition. This part of the plant is now monitored to the same standard as the rest of the plant.

In order to perform specific surveillance tests, all sprinklers installed on the plant have to be listed and isometric drawings of spray lines have to be produced, as no design drawings exist. Equipment codes are then assigned to each sprinkler and entered into the equipment database. Surveillance test procedures are then drawn up and grouped together per spray line.

As an example, we have identified more than 700 sprinklers per unit, which are listed on approx. 80 isometric drawings. The number of surveillance test procedures is estimated at approx. 25 per unit, depending on how they are grouped together.

The plant aims to have drawn up all spray line test procedures for the electrical building, where sprinklers play the most important role, and to have performed some of them by May 2006. The diesel generator rooms, the fuel building and the nuclear auxiliary building will be dealt with by September 2006.

The procedure for draining down, flushing and drying the spray lines after filling with water is currently being drawn up. It will be applied in the event of spurious water intake and incorporated into operating procedures.

A programme designed to monitor spray line blockage by dismantling a sprinkler located on a low section of each line will be drawn up by the end of 2006 and applied in 2007. Indeed, the creation of this procedure requires an exhaustive knowledge of sprinkler lines and associated isolation valves.

Sampling tests associated with the thirty-year maintenance programme will be examined at the end of 2006 and in 2007.

### **Fireproof wall penetrations:**

As part of the effort pertaining to the corporate “fire action plan” (called ‘PAI’), aiming to improve nuclear safety and industrial safety fire-zoning in all nuclear island buildings, all penetrations located at fire zone boundaries have been examined with a view to taking corrective action if necessary.

There are more than 3000 penetrations per unit located on the boundary of the new fire zones. On the basis of this examination and the requisite equipment identified by corporate engineering centre (CIPN), the list of non-compliant penetrations has been drawn up. These penetrations are being reworked and the plant has made a regulatory commitment to have this rework completed by the end of 2006.

There are 1616 penetrations to be reworked on unit 1 and 1472 on unit 2.

At present, more than 30% have been completed on unit 1 and more than 80 % on unit 2.

Furthermore, penetration integrity will be ensured via a preventive maintenance programme involving period checks.

## **IAEA Comments:**

The Operations department, site, and corporate personnel have identified and are implementing the actions to resolve both the sprinkler and fire barrier penetration issue. The scope of actions and significance is much greater than anticipated by the OSART team. The actions taken to date and schedule demonstrate satisfactory progress on this issue.

### **Conclusion: Satisfactory progress to date.**

#### **3.7(a) Good practice:** Fire scenarios of the response organization for specially recorded sites

Nine fire fighting scenarios are designed and included in the emergency response organization of the NPP (PIER). They focus on premises where the risk is seen as being significant (safety, fire load, impact on the environment, propagation).

They have been designed by the NPP, presented to the fire brigade (about 60 members) during their visits of these installations, and then validated by the firemen after a detailed and thorough assessment, including the SDIS planners.

In each scenario, we find the critical elements to prepare for fighting a significant fire: building's structure, special risks, retention means for fire extinction water, equipment and actions to be performed, information transfer, fire fighting strategy, equipment location.

These scenarios are available in the command centre and the external rescue vehicles. PCD2, chief of relief operations, is the contact person with the chief officer of the fire brigade and he can share accurate, structured and detailed information in order to best manage the response in case of a fire.

The scenarios are used to prepare the joint drills with the firemen.

While they specify the necessary rescue actions, these scenarios enable to limit the fire propagation and allow for the response optimisation in terms of safety, industrial safety, radiation protection, environment and of damages to equipment.

These scenarios lead to improve both the organization and the response in case of a fire in the NPP and thus allow for a direct improvement of safety in the units in case of a fire as far as safety equipment is concerned.

#### **3.7(b) Good practice:** Fire zone identification

In the plant fire zone boundaries are exactly denoted to provide effective means of quickly identifying the various functional components at fire zone boundaries and ensuring that they are intact.

Workers are always able to identify the fire zone in which they are working thanks to a colour code system (red for train A nuclear safety-related fire zones, green for train B nuclear safety-related fire zones, and yellow for industrial safety-related fire zones) which matches up with that used on fire detection panels. Other means of identification include the numbering of fire zones, fire zone drawings available in the control-room and fire response procedures.

This information is indispensable for performing the requisite fire risk assessments prior to starting work and for carrying out the appropriate actions in the event of fire in these areas.

Identification of functional components at fire zone boundaries is facilitated by fire zone sign, even for workers whose knowledge of fire zones is limited.

Fire risk assessments performed on the plant (e.g. hot work permits) are facilitated by sign indicating fire zone boundaries.

As temporary storage of materials is prohibited in industrial safety-related fire zones, these zones are marked in yellow to facilitate their identification.

Initial actions intended to ensure personnel safety and plant safety must be taken within no more than 20 minutes of the alarm. Visual identification of fire zone boundaries contributes significantly to achieving this objective, because:

- It clarifies and facilitates initial actions taken by the first-line responder to contain the fire
- It facilitates evacuation of staff through safe access paths in the event of fire breaking out in plant rooms
- Access points to fire locations are clearly identified, particularly for off-site emergency response teams.

Improvements made to fire zoning through the use of fire risk assessments have been effective in improving fire risk prevention and have significantly helped to improve nuclear safety, industrial safety, environmental protection and plant safety.



## 4. MAINTENANCE

### 4.1. ORGANIZATION AND FUNCTIONS.

High level policies are in effect at the plant, which put safety first as a theme; the message is clearly stated.

Performance Indicators (PI) have been established, most are available to the staff members on the Electromechanical Maintenance (SEM) and the Instrumentation and Control (SAU) department's internal web pages known as FORUM; the team noted this as being a Good Performance. The staff members are encouraged to look at the various indicators on the webpage. Also each department reviews their performance with their staff in monthly meetings.

Since the opening of the electricity market the policies have changed to include a commercial aspect.

The maintenance programmes and practices are being analyzed and optimized for balance between safety, commercial and economic factors.

The management team are working hard to establish a strong safety culture with a good deal of success as a result.

There are working relationships between not only other plant groups, but also amongst the other maintenance groups. The relationships are reconciled at coordination meetings between the various maintenance groups and the operations groups. Also there are people seconded from maintenance to other groups such, as outage preparation, in order to get proper coordination and expertise in these areas.

The Wed 10:30 meeting is one example of a coordination meeting. The team encourages the plant to keep improving the coordination between the operations and maintenance work groups at these meetings so that work schedules are largely achievable and properly prioritized.

Contractors are extensively used and are required to perform to the same standards as the plant staff. Monitoring of contractors has been a problem in the past, however the plant seems to be aware of this and are considering steps to improve this monitoring. Training for the monitoring of contractors is being scrutinized and a policy document is pending. The team has a concern that these efforts be completed expediently. (See issue 4.1.1)

There is a good mix of experienced staff and younger staff. The younger workers are competent for most tasks; procedures and comprehensive work packages, which are reviewed during pre-job briefings, along with worker qualifications are used to facilitate correct and complete work.

A comprehensive career and training plan is produced for each employee, which satisfies the needs of the plant and ambitions of the employee. The team recognized this as a good practice (See good practice in MOA).

### 4.2. MAINTENANCE FACILITIES AND EQUIPMENT

Large, roomy, tidy and well-equipped workshops and office facilities exist in all Maintenance Departments.

Mock-ups are used to qualify tools and personnel as required; the Steam Generator mock-up is one example.

Tool management systems are in place and working quite well, the toolcrib is well stocked and well kept. Measurement and test tools are looked after in well-equipped metrology labs with good programmes. Toolcrib activities are largely handled by contractors in the SEM. This seems to be working well, they appear to be properly monitored. The SAU and the SAE groups have similar approaches to metrology; both are tracking their measuring and test tools well.

There are some fuses and connectors in the SAU metrology lab which plant staff use for plant spare parts, however they are not used for safety related equipment. The team encourages the plant to keep the use of all spare parts under scrutiny.

There are many hoist beams located above equipment in the field, which facilitate good conduct of maintenance practices. The equipment associated with these beams are stowed with respect to nuclear safety. The team noted this as a good practice. [See good practice 4.2(a)].

Lifting devices are not labeled with inspection information but are under the control of a single team. The team cross-references the devices and hardware in a database with a tool number, which is marked on the device, or tool description. The lifting devices are inspected prior to each use, but also have official annual inspections done by an accredited contractor. Although this arrangement is complex, it seems to be working well. The team encourages the plant to put inspection dates on their lifting equipment and hardware.

#### 4.3. MAINTENANCE PROGRAMMES

SYGMA is a database used to facilitate maintenance activities, both Preventative Maintenance (PM) and Corrective Maintenance (CM).

SYGMA and its modules are reviewed by technical people to ascertain the effectiveness of the PM programme by checking 'as found' conditions; EDF history and condition based data are used to keep the PM programme optimized for cost and effectiveness.

SYGMA is also used to track problem equipment, i.e. equipment with high breakdown occurrences or chronic equipment problems.

The seawater CVI heat exchangers' chronic leaks are tolerated and leak collection devices have been permanently installed on some of the heat exchangers. This installation is not considered to be a modification, rather an improvement and will be installed on the rest of these heat exchangers. According to plant maintenance personnel this modification does not affect nuclear safety but no formal risk assessment has been done.

The Team encourages the plant to clarify the applicability of D 5039-MQ/PR.12 with respect to non-safety-related and non-classified equipment to be in compliance with the MQ EPN – 7 definitions.

Predictive maintenance is still under refinement at Penly. New vibration analysis equipment has been purchased and staff have been trained in its use and interpretation. Thermography is being used for the most part to detect problems, it is not however being used as a Post Maintenance Testing (PMT) tool for checking bearing temperatures or checking for faulty terminations. The team encourages the plant to continue its efforts to refine this area.

An in-service inspection programme is established and has all of the proper authorizations and specifications.

EDF assigns a contractor to perform most of the NDE testing and the plant monitors the contractor's performance in the field. An EDF group of people who used to perform the NDE are now used to monitor the NDE testing by the contractor and Penly staff are used to

oversee the schedule and safety requirements of the contractor. There are also a few plant staff able to do dye-penetrant inspections. This arrangement seems to be satisfying the plant's needs and obligations.

The maintenance groups are working with the operations groups to identify deficiencies promptly. This is achieved via the 08:30 diagnostic meeting in which the groups identify emerging equipment problems and agree on the corrective actions required.

#### 4.4. PROCEDURES, RECORDS AND HISTORIES

The methods group in each department, which is made up of former field employees, writes good quality procedures. This group consults designers and manufactures to assist with procedure development and revision. Approval from technical and management personnel is sought prior to using first time procedures or making revisions for field use. Also in the SEM a procedure validation process exists.

The Temporary Modification process is partially computerized. There are separate risk analyses done for Nuclear Safety, and installation/removal of the modification. Color-coded tags are used in the field to demark the temporary modification. The team encourages the plant to use the words "Tranche en Marche" and "Arret de Tranche" (or equivalent) on the tags as well as color-coding to identify the unit condition. Use of the tag-out computer system (AIC) assists with the control and tracking of the temporary modifications. The database can be searched for existing temporary modifications. The master flowsheets are not updated (temporary mark-up), operations staff will know of temporary modifications via AIC and by having the corresponding dossier in the tagging supervisors' offices. The team encourages the plant to consider a method of indicating on their master flowsheets that a temporary modification is in place.

By PARC procedure all temporary modifications installed by the SEM group are painted a highly visible yellow for instant recognition in the field.

The only exception to this process is when the work requiring the modification is covered by an approved procedure and the work will be completed in the same shift.

SYGMA is the tool used to keep maintenance histories and records. Also extensive hard copy is kept. SYGMA can be and is being interrogated for trends. Maintenance coordinators and the respective technical people use it to check for problem equipment and optimal maintenance practices.

#### 4.5. CONDUCT OF MAINTENANCE WORK

Maintenance work is planned and authorized in advance of execution. The prepared packages contain all the procedures and tag-out information required for the work.

The contractors either develop their own packages which the plant reviews or use plant prepared packages, which are reviewed with the contractor.

PMT Intrinsic (shop) and System (operational) is carried out as described in the maintenance procedures.

Pre-Job Briefings with the workers are used to describe all aspects of the work to be executed including safety, quality, quantity, timeliness and reporting requirements.

The team noted that although there are some specific procedures, which describe foreign material exclusion (FME), such as the suite of fuel handling procedures, there is no

comprehensive FME programme. The team has made a recommendation in this respect. (See issue 4.5.1)

When staff are required to lift loads by mechanical means the exact weight of the load is either measured in a trial lift, or calculated, if not known in advance. This information is not always captured for future use. The team encourages the plant to capture this information by marking the weight on the component or recording it in a database.

Feedback from staff and contractors executing the work is effectively recorded in various databases. These databases are reviewed by a site committee, which is made up of line staff. The committee decides on the applicability and traceability of the feedback and assigns actions and tracks them to completion. This is an effective method of collecting feedback, it is new and still under development. The team noted this as a good practice. [See good practice 4.5(a)].

There was not much maintenance field-work in progress to witness; however management's expectations for good performance are high.

#### 4.6. MATERIAL CONDITIONS

The team noted that the rubber profiles set into the rail-tracks are a good performance. The rubber keeps dirt from building up in the tracks and also helps to lessen the footing hazard posed by the rail-tracks.

Housekeeping standards are posted in some conspicuous locations. These are the standards applicable to the area in which they are posted.

There is also a good system of signs in place to depict hazards in the various areas of the plant. Also the signs with small picto-grams which are put up where there is an ongoing maintenance work provide good information to personnel.

Management are setting a good example by doing wipe downs of leaks in the field, there is a low tolerance for puddles, slipping hazards and debris. The team noted that some improvement of plant material condition is still required [see issue 4.6(1)].

#### 4.7 WORK CONTROL

Maintenance is carried out at the request of operations and/or as an output from the 08:30 diagnostics meeting. Also, maintenance (PM) is scheduled via the normal work planning process. At the Wed 10:30 meeting it was noted that there were many P2 (do within one week) priority items, many more than the assigned workgroup could carry out. Everyone at the meeting knew this, but the priorities remained unchanged or unchallenged. After the meeting the workgroup coordinator suggested priority changes to the Shift Manager. The plant is encouraged to use the 10:30 meeting to challenge unrealistic priorities.

Management seems to know the work control performance numbers, and are starting to use them in their decision making. The team recognized the plant's work control activities as a good performance.

The SAU group has a unique method of having workers use a guide to prepare their own work packages. The team noted this as a good performance.

Some temporary arrangements have become permanent.

Scaffold and plastic around SRI HXs.

Leak collection on CVI HXs.

The team encourages the plant to install permanent equipment to facilitate work.

The turbine hydraulic GFR filter work was interrupted for something more urgent, according to the workers on the job. Also the SAU group's backlog is increasing. The team encourages the plant to keep close account of staff numbers as they relate to timely completion of work.

#### 4.8. SPARE PARTS AND MATERIALS

The procurement of spares is handled by technical staff (UTO), who ensure that the appropriate standards are identified for the spares. The parts are received in a way that ensures the documentation is reconciled with the actual part as required.

Storage in the general warehouse is very good. The warehouse is neat and orderly. There is an upgrade to the environmental controls in progress, also the automated parts dispenser is being modified because of an obsolescence issue.

The flammables and chemicals have a separate room with compatibility lists displayed on the exterior of cabinets.

Reactor components and safety related equipment are scrutinized for traceability and quality assurance documentation.

#### 4.9. OUTAGE MANAGEMENT

The organizational structure of the Outage Management team and the project-based approach have strengthened and will continue to strengthen performance in this area. The team noted this as good performance.

During the execution phase, daily meetings are held amongst those coordinating the outage plan/work. The plant is encouraged to make Nuclear Safety Overview, as an agenda item of the daily outage meeting. This overview should include an update of the plant status and the nuclear safety implications for the day's planned activities.

### **PENLY FOLLOW-UP SELF ASSESSMENT**

The OSART assessment of the maintenance area enabled us to reaffirm our existing guiding principles and to gauge progress made.

The efforts made in different areas have been assessed and recognised as being key contributors to reinforced safety culture among the teams.

We can quote the following examples:

- ✓ Pre-job briefings,
- ✓ Self-assessments performed within departments,
- ✓ Housekeeping and worksite standards,
- ✓ Equipment leak collection and monitoring,
- ✓ Cross-functional operating experience as well as experience feedback from the field formalised via progress sheets (called 'FPP'),

- ✓ Management methods used for the outage and power operations project reviews.

In addition the OSART mission also showed us paths for progress so as to reach international standards. Three issues were identified where performance was insufficient :

- ✓ Contractor monitoring
- ✓ Material condition
- ✓ Foreign material exclusion.

We have therefore used the years 2005 – 2006 as an opportunity to make sustained progress and to correct our weaknesses TOGETHER thus guaranteeing robustness over time. All these actions are aimed at involving plant personnel in obtaining sustainable results as well as making lasting improvements in plant safety.

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

In the area of Maintenance (MA) the team has concluded the Maintenance department has identified appropriate actions to resolve two of the three issues and have made significant progress on the third item. The Maintenance organization is committed to improving plant material condition, improving contractor performance, and enhancing foreign material exclusion (FME) practices.

The organization implemented actions resolving the issues pertaining to the control of contractors and foreign material exclusion. Improvements in both of these areas will result in improved plant performance and safety.

The actions and plans laid out for the continual improvement of the site material condition are comprehensive and detailed. The actions taken to date have resulted in a marked improvement of areas such as the pump houses. The long term plans (2007-2010) are broad and when fully implemented will move the site material condition to a high level. The staff is commended and encouraged to continue these improvements.

## DETAILED MAINTENANCE FINDINGS

### 4.1. ORGANIZATION AND FUNCTIONS

**4.1(1) Issue:** Monitoring of contractors work execution needs improvement. There have been some events in the past and also some noted deficiencies during field inspections.

- TEG 106 VY IN not sealed.
- RVs off of the Aux. Boilers not sealed.
- 2 AHP 113 VV not sealed.
- 1 DVL 106 ZV fastener missing from inspection cover.
- 1 DVL 108 ZV is inaccessible due to its height and a cable-tray is blocking the direct access. The work was recently completed, however no means of temporary access was evident, the risk assessment sign had no indication of ladder usage. It appears access was accomplished by standing on the cable tray.
- At the worksite in General Warehouse where the automated dispenser is being modified the worksite was left untidy, tools and scrap material left lying on the floor. This work was being done by a contractor.

Contractors are employed extensively at Penly. They work on all systems. The quality of their work must be very high and as such closely monitored; this is directly related to plant safety.

Without close monitoring of all contractors work, the quality of work cannot be assured and may degrade plant safety.

**Suggestion:** The team suggests that consideration should be given to improving the monitoring of contractors during work execution. The plant is already considering strengthening its performance in this respect and should proceed with this effort diligently.

**Basis:** IAEA Safety Standards NS-G-2.6, 3.6, 3.7, 3.9

#### **Plant response/action:**

The various aspects of contractor supervision were jointly reviewed by all departments in 2005. Areas for improvement were finalised at the end of 2005, with an accompanying action plan including the following points :

#### ▶▶ **Overhaul and standardisation of the role of contractor supervisor**

Departments have gradually been converting the role of work checker into one of contractor supervisor by focusing this role exclusively on contractor supervision. Activities aimed at facilitating job performance have been discontinued and assigned to another entity.

#### ▶▶ **Bringing our reference base into line with the corporate reference base**

The Penly reference base has been set out in the form of a technical specification (governing procedure).

#### ▶▶ **Development of specific training focusing on the role of contractor supervisor**



A training course (code M800) was initiated in 2005. 26 workers have undergone this training. The course has been incorporated into standard training plans and prerequisites are set out in training specifications.

▶▶ **Standardisation of department supervision plans**

The document used as a basis for contractor supervision is common to all departments. It is accompanied by a guide designed to facilitate preparation for and collection of findings in the field. Guidance in its use has been provided by department senior management teams, via:

- ✓ a presentation of prerequisites for performing the role of contractor supervisor, prior to the M800 training course.
- ✓ coaching of contractor supervisors during outage, via situational training sessions.

▶▶ **Contractor supervision programmes have been enhanced for power operations as well as outage activities**

Coaching has been provided by the department leadership prior to the drawing up of these programmes by contractor supervisors. Efforts to assess the quality of these programmes have been initiated via department monitoring plans.

Experience feedback from these actions will be reviewed at the end of 2006.

**IAEA Comments:**

The actions taken by the Maintenance department fully resolve the issue identified by the OSART team. Guidance and training has been provided to the contract supervisors. This guidance coupled with standardization of a contractor supervision document will ensure more consistent and improvement in contractor control.

**Conclusion: Issue resolved.**



## 4.2 MAINTENANCE FACILITIES AND EQUIPMENT

**4.2(a) Good practice:** The team recognized the stowage of field installed hoisting equipment as a good practice. This practice consists of placing lifting equipment located near safety-related equipment in a secure state to protect against damage to seismically qualified equipment. An ingenious, award winning hook has been developed to assist with this practice.

The main actions carried out consisted of:

- Hoists located above safety-related equipment were removed.
- The slack from the chain on the hoist carrier was coiled around a metal hook so as to prevent the chain from swinging free and the carrier from moving.
- Safety stops were installed on the booms.
- Safe stationing positions were identified on the beams for all handling equipment at risk (hoist carriers, cranes, etc).

A set of actions easy to implement and which prove the compliance of lifting equipment with the nuclear safety reference for 1300 MW series (topic “external hazards of natural origin - earthquakes”).

## 4.5 CONDUCT OF MAINTENANCE WORK

**4.5(1) Issue:** A comprehensive foreign material exclusion (FME) programme is not evident.

Although there is an expectation for foreign material to be excluded from plant systems, or for systems to be cleaned before final assembly, there is no procedure, equipment or training available to support the worker in this endeavor.

Some examples are:

- In room NB1002, adjacent to the room of the spent fuel pool, there is a tool approximately 3 m long, both ends wrapped in clear plastic.
- Some of the new stator water piping ends were left uncovered
- 2 CVI 002 BA is taken apart for maintenance. The tube bundle is not covered. The pipes that attach to the heads are covered in a non-standard manner; one had a flange on it, others were covered with plastic and tape.
- There was a small transparent plastic bag (which contained smear samplers) found in the vicinity of the fuel bay.
- Tools wrapped in transparent plastic found in the Hot Workshop. The clear plastic is the standard way to wrap contaminated tools for transport out of the RCA according to the staff in the Hot Workshop.
- When questioned how they prevented foreign material ingress to the turbine governing system’s hydraulic fluid package while performing filter change-outs, the workers remarked that they found some plastic to cover the openings.
- Cool ELF addition tank in Diesel Buildings not sealed nor secured could become easily contaminated with foreign material.
- FME requirements are described by risk assessment group, however the worker must decide how to comply based on professionalism and experience. When asked about these FME practices the manager agreed that this was the normal approach.

- Workers are not given training as to compatibility of cleaning agents with process fluids and materials.
- A transparent plastic dispenser is used in the SAU metrology lab to wrap instruments, which will be used in the RCA. No apparent concern about this was noted from the SAU department.
- There are also transparent plastic dispensers in the general warehouse, as well many parts in the warehouse are wrapped in transparent plastic.
- The new generator stator cooling water purification system is being assembled. Material is laid down on the floor grating near the stator cooling system. Not all of the ends of the small-bore piping are covered.
- There is also inexpensive material and equipment available on the market to support such a programme.

The lack of a comprehensive FME programme challenges workers to meet FME expectations and could eventually lead to plant system degradation which could impair safety systems. Also, additional maintenance in the form of filter changes, valve refurbishing, instrument line replacement etc... may be required when an effective FME programme is not in place.

**Recommendation:** The plant should implement a comprehensive foreign material exclusion programme. There are many good examples throughout various industries to emulate.

**Basis:** IAEA Safety Standard ref. NS-2.5, 3.19, 6.8 and good international practice.

### **Plant response/action:**

In attempting to address the recommendation, we have focused on the following points:

#### ▶▶ **Foreign material exclusion reference standards**

These reference standards have been set out in a procedure, with the aim being to reinforce safety implications as well as to assist workers in the choice and handling of exclusion devices best suited to the job in question.

#### ▶▶ **A "standard" foreign material exclusion system has been developed for equipment located outside the radiologically controlled area.**

In order to facilitate implementation on worksites, a flexible covering device has been designed and made available to workers in the site tool stores. A fastener made of elastic cord holds the cover device in place. The device can cover all circuit openings ranging from 100 and 1000mm in diameter.

#### ▶▶ **Document pool**

The document pool has been reviewed in order to assess the extent to which the foreign material risk has been addressed. It has been shown that while the expectation is clearly stated in quality plans, it is not always clearly identified in work procedures. The significance of this risk has led us to address the finding in two stages:

- The key points of the foreign material exclusion reference standard have been summarised in the form of an action sheet appended to work packages, in order to help workers choose the most appropriate covering device.

- Deployment of this expectation has been clarified in those vessel procedures without systematic quality plans. After reviewing 250 procedures, we managed to improve the content of 125 documents.

#### ▶ **Communication and implementation on worksites**

The flexible covering device was demonstrated to workers as part of a safety forum and concrete implementation of the new reference standard is strictly monitored on the occasion of management plant tours.

#### **IAEA Comments:**

The team noted the actions taken address the issue. The site has implemented a procedure containing the standards to be utilized by Maintenance personnel when opening systems or components. Work packages have been modified to include references to the standards. The department has obtained flexible covers to be used on secondary plant system or components. The covers were observed by the team being utilized in the plant.

#### **Conclusion: Issue resolved.**

**4.5(a) Good practice:** The team recognized the contribution by maintenance staff to operating experience as a good practice.

In maintenance, technicians feed the operating experience originated from the field into a Permanent Progress Sheet (FPP) or into suggestion books. This feedback leads the technicians to suggesting improvement solutions.

Examples:

- Suggestion for improving a handling device that is not well adapted,
- Improvement of a tool lacking efficiency,
- Improvement of the clarity of maintenance worksheet or procedure,

These suggestions are submitted for approval to the team leader in charge of performing the technical check on the finding. Once accepted, they are tracked via a computer file with a processing deadline depending on their importance (industrial safety, nuclear safety...).

The contribution by the staff to operating experience is also made evident by the local events analysis, formalised in event reports called CREL. These are identified either by line management, or by the employees themselves after identifying low-level events.

- A high level of feedback (FPPs or suggestions) reported by the staff, especially since 2003 (110 in 2002, 417 in 2003 and 348 in 2004).
- An ever decreasing number of significant operating events for which maintenance is responsible (7 SOEs in 2002, 3 in 2003, 1 in 2004).
- Numerous local events analysed (CREL) in order to integrate OE in our daily activities and practices (22 CRELs in 2003, 22 in 2004).
- The amount of FPPs and suggestions produced in the framework of OE is stimulated by the managers' commitment to respond with rigor to any feedback coming from the field.

- Employees may consult at any time the progress status of FPPs and suggestions in computer files available via the maintenance department forums.
- The organisation of FPPs and suggestions corrects weaknesses detected as close as possible to the field. Reduction of deviation findings enhances nuclear safety and productivity.
- The quality and amount of FPPs and suggestions gives credit to individual and collective work. It participates in individual recognition (it is a management tool).
- FFP favours communication within the team as well as with other departments.

## 4.6 MATERIAL CONDITION

**4.6(1) Issue:** The material condition of the plant needs to be improved. The team noted this in the numerous observations of the plant on the initial plant tour and by the instances noted below, depicting conditions below desired plant standards.

An average number of leaks are evident, most are contained/controlled and identified for repair.

The plant Electromechanical Team started a leak detection and tagging effort in 2003. There are over 400 leaks now identified and controlled as the result of a leak search campaign. The Electromechanical Team is working with the Operations Teams to identify, control and tag leaks as soon as practical after their discovery.

- Structures in the bottom level of U2 Turbine Hall show signs of corrosion due to flooding from an overflowing sump. The cause of the overflowing sump has been remedied, but the damage to the structures has not been dealt with.
- Turbine hall 0.0m, there is leaking steam and oil of turbine driven feedwater pump.
- In some areas of the plant the floor surface and painting is a little bit rough and partly mended.
- Unit 2 Charging pump 2A had a significant buildup of boric acid from a leak on the inboard seal.
- Phosphate leaked at room of Spray Pump 1 and was not wiped up.
- Leak tracking system and dispositioning appears to be a good one, however it needs to be utilized consistently.
- Turbine hall 0.0m, traces of leaks were observed on all four vacuum pumps (2CVI 004 BA). It can be an indicator of a common unsolved technical problem.
- Corroded pipe connections, valves and flanges, in various areas of the plant.
- Recent and actual oil leakage from a crane motor was found on the floor.
- Small leakage on the floor of the corridor in Waste Treatment Building.
- Dry boron deposit on the stem packing of valve RCV 267 VP.
- Significant amounts of boron deposited on the tray below pump 1 RCV 191 PO.

The plant has made significant improvements with regard to its material condition however; the plant is encouraged to continue its improvements in this area.

Without continuation of the material condition improvements of the plant, system and component failures can occur.

**Suggestion:** Consideration should be given to continuing or even accelerating the effort to improve plant material conditions. By continuing with this effort a message will be sent to the staff that continuous improvement in all aspects of the plant operations is the goal.

**Basis:** IAEA Safety Standards NS-R-2 sec. 5.17, INSAG-12 sec.116, INSAG-13 sec. 92 and industry best practice.

### **Plant response/action:**

▶ A long-term schedule spanning the period of 2007 – 2010 has been drawn up with a view to achieving and maintaining exemplary plant and material condition at Penly NPP. This schedule includes the repainting of plant rooms, corrosion treatment, circuit integrity,

refurbishment of certain systems (indoor fire-fighting water distribution, TRI, pump house ventilation, etc.) and dealing with water seepage in the turbine building and diesel generator buildings, etc. The integrity of buildings forming part of the nuclear island is being dealt with via a corporate maintenance programme and painting operations for metal structures have been defined in a local preventive maintenance programme.

▶▶ Every year, the plant draws up a specific paintwork budget for its buildings and systems (200k€). This budget is also used for certain civil engineering jobs and the replacement of badly corroded metal structures where repainting is not an option (guard rails, doors, pipe supports, etc.).

▶▶ Both pumphouses were refurbished in 2005 and 2006. The main causes of corrosion were identified and remedial actions were scheduled (cement covers in rooms PA & PB 107 on units 1 and 2 in order to guard against stagnant water, replacement of pump house motor-driven fans in progress, screens to protect against splashing water from trash rakes are in place, etc.). Rooms and equipment have also been repainted wherever necessary.

▶▶ Corroded gates and fences are continuing to be replaced. An annual budget of 10,000 € has been allocated.

▶▶ Plant and material condition monitoring performed by the electro-mechanical department on 01/03/2006 shows a significant drop in the number of leaking items of equipment. 200 leaks have been counted at present, as against 400 in 2003.

▶▶ Since the OSART mission, the crafts have continued to address plant and material condition deficiencies and the number of resolved deficiencies went from 1700 to approx. 2850 in March 2006.

▶▶ Management and behaviour: Every nuclear safety-qualified worker is reminded of the fundamentals on the occasion of nuclear safety refresher courses, where the link between nuclear safety and plant condition is established. New employees undergo a day of shadow training with the plant and material condition team.

### **IAEA Comments:**

The actions and plans laid out for the continual improvement of the site material condition are comprehensive and detailed. The actions taken to date have resulted in a marked improvement of areas such as the pump houses. The long term plans (2007-2010) are broad and when fully implemented will move the site material condition to a high level. The staff is commended and encouraged to continue these improvements.

**Conclusion: Satisfactory progress to date.**

## 5. TECHNICAL SUPPORT

### 5.1. ORGANIZATION AND FUNCTIONS

Technical support (TS) activities are spread between several departments at the plant. The organizational structure and job descriptions are clearly defined and documented in administrative procedures.

Responsibilities and authority have been clearly defined for plant management; outage management and operations management at all levels. Management committee meetings (RDT), chaired by the Technical Director – have the power to make decisions on all technical and safety problems, including authority to spend money above the approved plant budget if necessary for safety. The team considers this as strength.

The plant departments, performing TS activities, have sufficient staff to cope with operation and outages of the units.

Appropriate goals, objectives, and performance indicators are introduced into all levels of the plant structure. The main indicators are tracked and reviewed regularly.

The Plant operation annual report is issued regularly every year. In the report, the top five issues for six functional categories are analyzed and compared in terms of their effectiveness (benefit versus work load). The report gives to the senior management the overall picture to make further improvement of the plant performance.

Management commitment to safety is strong.

EDF corporate departments are providing sufficient assistance and support to the plant TS activities.

A representative of the EDF Design Center for Nuclear Park (CIPN) is constantly situated at the site, working closely with the plant Engineering department on process optimization, investigation of the problems arising, design modifications, experience feedback.

UNIPE - Corporate NPP Operational Engineering Department is responsible for the national major modifications, general operations rules and fuel investigations to EDF NPPs.

UTO - Operational Technical Unit is responsible for providing assistance to the plants in major maintenance activities, spare parts and experience feedback with regard to plant unit outages.

CAPE - (Operations Support Center) - provides support to site on the basis of experience feedback and the sharing of good practices, contributes to the drawing up and management of the division's technical strategies, monitors technical decisions, contributes to modifications management.

The team considers this as strength.

The plant has effective planning and scheduling computerized system incorporating surveillance, maintenance and operations activities.

In the year 2004 an INES 2 generic to other French NPPs' event was identified due to poor contractors' work and supervision during the construction of the units and modifications implementation. An enforced supervision practice has been applied since recognizing of the root causes of the event.



A system for training of the technical support staff as a part of overall plant personnel training system is applied. The training is performed at corporate level and at Penly NPP training center and within the departments.

A training coordinator in each department tracks each personal qualification.

The function of technical director was established two years ago in order to enhance plant performance in the technical support area. According to the technical director job description, this person is responsible for solving significant middle and long-term technical issues. Responsibilities of the deputy plant director and the technical director are arranged well.

## 5.2. SURVEILLANCE PROGRAMME

A comprehensive surveillance programme is incorporated in the units' General Operations Rules (Technical specifications).

The departments' responsibilities are clearly defined in the surveillance programme and clear communications are established. Standard surveillance scope and methodology including components to be surveyed, surveillance condition, surveillance period and action to be taken in case of deviation are developed by reactor type at the corporate level and are implemented at each plant. The Engineering department develops plant specific surveillance plan and the Safety and Quality department incorporates it in the plant's documents (SPE001 and SPE053) including differences from standard surveillance plan and responsibilities of the plant departments. The surveillance plan is incorporated in the plant programming database (PRV) and is updated when necessary. Designated departments develop the relevant surveillance procedure.

The surveillance programme as a whole ensures early failure or deficiency detection of the safety significant equipment.

A safety functions monitoring system (SFMS) was developed in Penly NPP. The system evaluates six safety functions that allow senior plant management to quickly have information on current units status. The SFMS outputs are presented at the weekly management meetings to facilitate appropriate remedy measures if necessary. The team considers the implementation of this system as a good practice.

QA requirements are developed for surveillance programme implementation and documentation.

The EDF corporate department UNIPE develops periodical test rules for the whole surveillance programme. The French Nuclear Safety Authority (ASN) approves the periodical test rules. On the basis of the periodical test rules, the responsible departments develop detailed procedures. The plant departments elaborate periodical test rules and procedures and operate the units with them. The local regulatory body gives permission for unit startup after evaluation of these rules and programmes. The requirements in this area are not clearly defined and the plant is encouraged to work closely with the regulatory authority to ensure that all test rules are clearly understood.

The plant administrative procedures and computerized system for planning and scheduling allow strict control of surveillance frequency and avoid conflicts with the maintenance and operations activities. A summary document, including description of the test and equipment required, test criterion, safety impact of criterion (type A or B), deviation status and test frequency, guarantees that all test criteria required by the corporate organization (testing



programme) have been integrated in plant test procedures. It is a link between the current plant reference base and the actual test procedures, used in the plant departments. Thanks to this document, the plant is sure that the corporate requirements in the area of periodic tests are integrated, both internally and towards the regulator. The team appreciates this practice as a good performance.

Acceptance criteria are clearly defined in the test procedures. The test procedures include foreseen corrective actions in case of unsuccessful tests. Independently of test results, the unit is set to the status required by general operation rules.

The procedures used for periodic testing include a decision-making flowchart for the acceptance of test criteria, which summarizes actual test performance. It makes a clear distinction between criteria A (nuclear safety) and B (equipment) that need to be complied with, directs test completion as being satisfactory, satisfactory with reservation or not satisfactory. If necessary, additional analyses are required and requests for application of technical specifications if a test is not successful. The flowchart integrates all conditions determining that a periodic test is successful. It directs operators to the arrangements to take based on test results. The team considers this approach as good performance.

However, with very few exceptions, the safety significant events and the surveillance programme test results are not trended. In the absence of trend analysis of the surveillance programme test results, plant deviations from design intent or ageing trends may be missed and the team has made a suggestion in this area.

### 5.3. PLANT MODIFICATION SYSTEM

Plant modifications of safety related systems are carried out in two different ways: so called national modifications, which are common for all EDF 1300 MW units and local modifications, which are specific for one or both Penly NPP units.

The programmes, contents, design and implementation of national modifications are performed by the EDF corporate support organizations, including approval by the regulator. The modifications are prepared as batches (modification packages) with safety evaluation of each modification included in the batch and joint safety analysis report. An ALARA sheet with dose budget is included in the documentation for each modification. Currently under implementation is the batch that was approved in 2001, with terms to be finished in 2005. The financing of these modifications is covered at corporate level. The plant responsibilities for implementation of national modifications are limited to some auxiliary functions.

The departments propose local modifications with preliminary safety and financial evaluations included in the proposal. The engineering department is in charge of final safety evaluation of the proposal. The decision for implementation of the proposed modification is taken at the technical management meetings. If the proposed modification is safety significant, it is sent to the EDF corporate organization UNIPE, which evaluates if the proposal can be applied at all NPPs. UNIPE also verifies the proposal, performs the design and approves its implementation. The modification has to be approved by the plant technical director before implementation. The safety authorities consider UNIPE's approval as sufficient proof and the plant can start its implementation.

The Modifications department, composed of representatives of corporate engineering departments and Penly NPP personnel, is responsible for coordination of all national and local modifications activities at the site. For each modification, a special coordinator is

appointed. The relations, responsibilities and obligations of all corporate and plant structures are set in written procedures.

The shift manager is responsible for plant safety assessment during the implementation phase.

Two years ago a new computerized system for temporary modification tracking and control was developed and implemented by the Operational department. At the present time all temporary modifications are included in the system. In spite of the relatively high number of temporary modifications (60 for Unit 1, 51 for Unit 2 and 13 common), they can be effectively controlled with the help of the new system. Temporary modifications are indicated by painting and/or by labeling. Verification of all temporary modifications is performed before the units startup and with 4-month frequency. The plant management intends to reduce the number of temporary modifications drastically by converting them into permanent ones, as most of them were implemented a long time ago (some of them left from the construction phase of the units).

Post modification tests are performed before handover to operations. An integrated startup verification system for post modification functional test tracking is developed at Penly NPP, granting the operational staff and safety quality department supervisors to have a brief and effective access to modification tests results before changing of the reactor condition. The team considers this system as a good practice.

#### 5.4. REACTOR ENGINEERING

The activities in the area of core management are distributed between the corporate engineering organization UNIPE BC and the plant departments. UNIPE BC provides the plant with core maps for the following fuel cycles and with start test requirements and criteria. During normal operations, UNIPE BC provides the plant with monthly reports on core physical parameters, based on the results of the in-core flux monitoring system.

The plant Technical department develops respective detailed procedures for start-up and normal operation tests. The testing section of the Technical department develops QA plans for start up tests and tests for normal operation. A core coordinator is appointed to supervise and control test performance on line, having a comprehensive overview of the tests, criteria and logical diagram (for start-up tests).

The respective departments perform the tests.

The core engineer from the engineering department is in charge of supporting core-aided activities and liaison with the corporate engineering organization. The core engineer systematically meets with the testers to make them specifically aware of sensitive activities and more responsive in detecting and processing deviations (reminder of status, integration of experience feedback, presentation of changes in work documents and test procedures, reminder of corporate requirements). This system enhances testers' involvement and responsibility. Thanks to this organization, implemented at the beginning of 2003, the physical test schedule has always been complied with and has not led to any safety significant event. The team considers this approach as a good performance.

A cross-functional QA document specifies relations between all parties involved in reactor engineering activities.

Special attention is paid to the reactor operation during extended fuel cycle. At daily “diagnosis” meetings, chaired by the shift supervisor and attended by representatives from the Technical, Operations and Maintenance departments, with the attendance of the plant physical test coordinator: decisions are made for formalized strategy for the next 24 hours on extended-cycle related parameter setting, in joint agreement with all relevant crafts and proactive planning of extended-fuel related activities. This approach, developed by Penly NPP, enhances plant performance during that sensitive period by fostering forward planning of sensitive parameter setting and proper control over related risks. The team considers this approach as a good performance.

## 5.5. FUEL HANDLING

The requirements for the movement of heavy loads are stipulated in chapter 3 of the general operations rules. Transportation of any load above the reactor cavity and the fuel pool are forbidden, with the exception of the technology required ones (for example –reactor head and internals handling). The containment coordinator and refueling manager are responsible for the control of heavy load moving and compliance with the requirements.

The corporate nuclear fuel division DCN is responsible for scheduling and delivery of the fresh fuel. A responsible person from the plant staff has been appointed to audit the QA requirements performance of fresh fuel transportation. He also checks the validity of the driver’s and the back-up drivers licenses for driving, for transportation of radioactive materials and industrial safety certificate. The vehicle technical condition and presence of special labeling are checked. Proper stowing of fresh fuel containers and availability of documents for radiation measurement and cleanliness are checked.

The transportation company is responsible for proper transportation of fresh fuel – complying with speed limits and with requirements on proper weather condition. The state security offices have to be informed about the transport route. In case of a traffic accident, the driver is responsible for calling the police and fire brigades.

The corporate engineering department UNIPE BC develops standards and procedures for new fuel handling and acceptance inspection. The fuel section of the plant logistic department is responsible for the interface with DCN, performs all necessary actions for fuel acceptance, inspection and disposal in the fuel pool after inspection. The plant engineering department is supporting the fuel section, and provides long term planning for fuel disposal in the fuel pools.

After the Tokay Mura accident, systematic safety reviews have been performed at plant level and corporate level in order to evaluate criticality risks during fresh fuel handling. The reviews’ conclusions show that there is no criticality risk for Penly NPP.

The core maps for the new fuel cycles are calculated and provided to the plant by UNIPE BC. The fuel section elaborates the step-by-step core loading patterns, following Procedures 40 and 41 requirements. The engineering department is providing supervision of the fuel section activities, provides training and pre-job briefings to the refueling staff and liaises with the regulator. The refueling machine operator, supervised by the refueling manager, performs each fuel assembly movement in the reactor hall, following a step-by-step procedure, one sheet per movement. In the same way in the fuel building the crane operator, supervised by the deputy-refueling manager, finishes the unloading operation.

All fuel movements are recorded accurately and stored in the fuel section.

A full scope sipping test of the fuel assemblies is performed after their unloading if the respective criteria for fuel cladding integrity are not met. The radiochemistry analysis for Xe133 and Xe135 isotopes during preceding operation are used for fuel cladding integrity evaluation. The assemblies detected as leaking cannot be reloaded. UNIPE BC recalculates the new core map and all necessary changes are made in the fuel-loading pattern.

The spent fuel is stored in the fuel building pool outside the containment. The pool temperature and chemistry parameters, including boron concentration, are kept in accordance with the requirement of the general operations rules. Spent fuel is regularly sent to the COGEMA reprocessing facilities in order to make room in the fuel pools. The filling of the transport cask with spent fuel is made in the presence of a COGEMA representative. The responsibilities for the spent fuel are transferred from Penly NPP to COGEMA at the train terminal near the plant.

The fuel section is responsible for the records of each fuel assembly history, changes in the inventory, the monthly and yearly inventory reports to the safety authority.

## 5.6. COMPUTER APPLICATIONS IMPORTANT TO SAFETY

The EDF computer hardware and software belongs to the corporate power operation division (DPN). DPN is responsible for supplying the plants with new computer materials and software upgrading. This policy assures hardware and software consistency for the whole nuclear fleet. In 2001 the hardware for the information system was renewed. For 2005 it is planned to change the computer operational system to Windows 2000.

Information technologies (IT) group from the logistic department is responsible for the information system maintenance at Penly NPP. The IT team was granted ISO 9001 certification at the beginning of December 2004. It is the first department at Penly obtaining ISO 9001 certification.

The corporate document IN 26 imposes QA requirements to all nuclear fleet information systems. The software in the information system is classified according to its importance to safety. All safety analyses related to the requirements in corporate instruction IN 26 are done using the root-cause analysis methodology. This method guarantees proper control over the impact of a given safety-related software on its environment.

A strict IT management system controlling access to software applications is in place at the Penly NPP, for instance access to the computerized tagging software (AIC). In this process, the operations department establishes operations and maintenance staff standard profiles and grants access to the software accordingly. The two IT representatives at operations are specifically responsible for granting access. To close the QA loop, the IT team yearly benchmarks its list of authorized AIC staff against that of operations. The team considers this as a good performance.

The emergency response team at corporate level responds in case of a request from plant IT group to cope with severe problems. Back up of the IT system data is performed periodically at a frequency depending on its safety significance in order to prevent loss of data in case of software or hardware failure (for instance, the backup frequency of the outage schedule is every four hours). An action plan for software development is carried out and access to its results is allowed for all intranet consumers for evaluation and suggested improvements. At the quarterly meetings with departments, the end users satisfaction is evaluated. This year results show a 90% customer satisfaction rate.

## **PENLY FOLLOW-UP SELF ASSESSMENT**

The OSART mission that took place in December 2004 provided technical support staff with a constructive and beneficial outside perspective.

Indeed, it corroborated the legitimacy of still recent structures at technical senior management level and helped the plant to identify worthwhile areas for improvement.

In particular, site senior management was made aware of a weakness relating to the early detection and processing of technical challenges, via the suggestion issued on trending.

Thanks to this suggestion, Penly NPP was able to initiate a far-reaching programme which, right from the outset, has met with approval among all staff members.

A local think tank therefore started tackling the difficult task assigned to it and within a year, came up with simple and pragmatic proposals for significantly improving the plant's trending and trend analysis activities. These proposals started being implemented in the third quarter of 2005, with plans for them to be extended much further by the end of 2006.

These aspects, combined with experience feedback, have also made us realise that we could extend this proactive approach to cover a much wider scope, of which trending forms a part.

This resulted in the decision to develop an "equipment performance and service life" process for the site, based on international benchmarking and on methods used by the best performing plants around the world.

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

In the area of Technical Support the OSART made one suggestion related to trend analysis.

An impressive programme for trending parameters of periodic surveillance tests and preventive maintenance data is being set up by the plant based on the WINSERVIR software application. The full implementation of the programme will allow the plant to detect early trends of deteriorating equipment performance or conditions, thus it will allow analysis of the technical problems and the implementation of corrective actions before limits of unacceptable performance are reached. This way this programme is in line with the guiding principle of senior management to be more proactive and anticipative. The SURVAODIAG system used to monitor performance of rotating equipment has already brought its first tangible results of application.

Therefore the team concluded that the plant has achieved satisfactory progress in addressing the suggestion concerning trend analysis.

## DETAILED TECHNICAL SUPPORT FINDINGS

### 5.2. SURVEILLANCE PROGRAMME

**5.2(1) Issue:** Trend analyses for the surveillance programme test results, with very few exceptions, are not performed within and outside accepted bands of the operational limits.

Trend analysis is not performed for:

Surveillance test results at the operations and technical departments;

Safety parameters of the units (up to now only nine parameters are monitored);

I&C department is started to perform trends for only one parameter for maintenance purposes since 2003;

The development of a system for trend analyses is foreseen to start in the next year.

Without performing trend analysis for the surveillance programme test results, plant deviations from design intent or ageing trends may be missed.

**Suggestion:** Consideration should be given and the plant personnel should be encouraged to develop and use trend analysis for the surveillance programme test results within and outside accepted operational limits, in order to anticipate detection of plant deviation from design intent or ageing trends.

**Basis:** IAEA Safety Guide NS-G-2.6, sec. 2.11, 2.12.

#### **Plant response/action:**

At the time of the OSART mission in 2004, test results were just starting to be trended but this trending was confined to a small number of parameters and was spread over a number of different databases.

In response to this suggestion, a large-scale project was initiated by the site. Its aims were to define and standardise trending and trend analysis by implementing a recognised process, to centralise parameters in a single database and to trend a substantial number of parameters in order to be able to perform efficient technical monitoring.

The project consisted of a number of phases:

- ✓ Benchmarking of existing practices at site and fleet level
- ✓ Review and validation of the project
- ✓ Selection by crafts of relevant parameters to be trended, out of 4500 surveillance test parameters. Trended parameters comprise analogue data from results of tests required to be performed by the general operating rules and from tests required to be performed within the scope of basic preventive maintenance programmes.
- ✓ Selection of a suitable computer program for trending activities
- ✓ Inputting of parameters into the computer program and compilation of 350 "trending rounds" including the 1400 parameters selected for both units.



The WINSERVIR computer application, used for keeping track of equipment monitoring rounds, was chosen as the primary tool to be used for trending purposes. The WINSERVIR database can be accessed in read-only mode by all staff.

It can be used to trend equipment characteristics, to perform comparative processing of collected data at predefined thresholds and to issue warnings if these thresholds are exceeded or if abnormal drifts are detected.

Specific tools dedicated to the diagnosis of rotating machines in particular (vibration, temperature trending, etc.) and batteries are additional facets of the trending project.

The structure set in place for the trending project is described in a site reference document (SPE 126) and is cascaded down via department organisational memoranda. It identifies 2 separate phases :

- ✓ "Trending", which comprises data collection as well as the detection and identification of discrepancies – conducted by departments involved in the process,

- ✓ "Trend analysis", where discrepancies are analysed in order to evaluate their acceptability in terms of equipment operability in the medium and long term, as well as its ability to maintain plant safety – conducted by equipment and engineering experts. This analysis also facilitates early identification of technical challenges, as well as the early performance of maintenance activities in order to guarantee plant service life.

The WINSERVIR tool is currently being tried out on a small number of parameters (demonstration of what the end product will be).

The actual start of the operational trending and trend analysis phase is scheduled for the end of June 2006. It will be gradually implemented on a much wider scale over the period spanning June to December 2006.

Future improvements to the trending project will have to be incorporated at the end of 2006, with the deployment of the ORLI computer program. Using parameters collected by the plant process computer, it will be used to trend secondary system equipment such as the main generator.

### **IAEA Comments:**

An impressive programme for trending parameters of periodic surveillance tests and preventive maintenance data has been set up by the plant. Four departments are participating in the programme with Engineering Department in the lead. The full implementation of the programme will allow the plant to detect early trends of deteriorating equipment performance or conditions, thus it will allow analysis of the technical problems and the implementation of corrective actions before limits of unacceptable performance are reached. This way this programme is in line with the guiding principle of senior management to be more proactive and anticipative.

The capabilities of the WINSERVIR software application were demonstrated using historical data retrospectively introduced to the database. However the site reference document (SPE 126) was approved on 12 April 2006. Therefore at the moment only a small part of the parameters selected for trend analysis (about 200 of the selected 1400) are part of trial application of the WINSERVIR system, and data registration has been started only at the end

of April 2006. Due to this reason no warning messages have been created and no interface sheet requesting engineering analysis has been issued.

The SURVAODIAG system is an EDF wide application to monitor performance of rotating equipment with analysis capabilities to identify causes of deviating performance data. This system has been introduced at the plant since the beginning of 2005. At present 34 items of rotating equipment are surveyed by SURVAODIAG and the first tangible results of application (e.g. identification of potential axial misalignment of pump and its electrical motor) have been reached. There is a plan to gradually increase the scope of application of the SURVAODIAG system.

**Conclusion: Satisfactory progress to date.**

**5.2(a) Good practice:** A safety functions monitoring system was developed in Penly NPP. The system is a simple and pragmatic method for assessing the status of key safety functions, based on the use of already available safety parameters.

Connected to a simple computer tool, this method enables plant senior management to have a monthly tracking system based on a set of indicators, representing the 'health status' of six main safety functions: containment, fire protection, reactivity control, core cooling, plant heat sink and electrical distribution.

Every month, this tool automatically tracks and processes around 450 parameters related to 60 elementary systems, making it possible to:

- Obtain an overall 'health and status' indicator with a set of various indicators (system based on green-yellow and red traffic lights), green meaning OK, yellow: warning, red: unacceptable;
- Be aware of equipment condition at a given point in time, thanks to spider web drawings. Any potential equipment failure can thus be identified;
- Display the status of the six key functions and all related elementary systems over the last 12 months. With this system, any negative drift can be detected at an early stage, for pro-active processing of potential equipment deteriorations
- The implementation of this method at Penly has led to ongoing safety improvements, as the relevant diagnoses are easy to obtain. This method can be reproduced at other plants, the resources necessary for its implementation being quite limited.



### 5.3 PLANT MODIFICATION SYSTEM

**5.3(a) Good practice:** An integrated verification system before unit startup has been developed at Penly NPP to capture modification tests. The system involves exhaustive listing of all required post-modification tests that have to be carried out before changing reactor condition. The related procedure is physically located inside the main control room (single binder) and in the corridor on a large poster size table.

Before the outage, the operations and safety quality departments validate these tables and during post-modification tests, they are filled in real time by the testing coordinator after validation and verification of test results.

The benefits of this method are as follows:

- The shift team is aware in real time of the physical status of modified equipment (and related post-modification tests)
- During outage safety meetings, it guarantees that all post-modification tests have been carried out before the operational staff is able to change reactor condition.
- The large poster-size table is strategically located in the corridor to the main control room, so everybody can have an overview of the situation at a glance. The operational staff and the Safety and Quality department are thus able to easily check changes in the reactor condition.

## 6. OPERATING EXPERIENCE FEEDBACK

### 6.1. MANAGEMENT OF OPERATING EXPERIENCE FEEDBACK

The high level of priority and importance that the feedback of operating experience or REX (an acronym for *Retour de Experience*) has for the top management of Penly NPP became clear to the team since the very first day of the mission. Nearly two years ago, by the end of 2002, a new interdepartmental function was implemented to foster and significantly enhance the feedback of the lessons learned from the operating experience into the daily routine of the professional staff. An operating experience (OE) coordinator was assigned and a series of actions and procedures were developed and implemented towards the objective to materialize in actions, the statement of the plant manager related to the REX process.

In Paris, EDF has a very strong team, which deals with the management of the operating experience, mainly from its own fleet. International experience, mainly from WANO, is also dealt with.

Penly NPP manages the operating experience information by different ways, using external expertise of EDF corporate and local expertise from individual departments personnel. Adequate human, technical and financial resources are allocated to the departments to perform their OE related tasks. Assessments of the implementation of the OE actions are done internally in each department, at least weekly. And at least two times per month, a meeting of the Committee REX takes place, chaired by the Plant Manager himself. This action is commended by the team.

External events, from the fleet of nuclear power plants of EDF, are received weekly by the OE coordinator, who pre-selects some to be analysed by the plant departments. Events originated at the plant are divided into two categories: the local events – CREL and the significant events – CRES.

Local Events (CREL) are the ones not considered safety significant events by EDF guidelines; their co-ordination rests with the OE Group. In 2004 eighty events were classified as belonging to this category. The OE Group has assigned one dedicated professional to coordinate analysis of these events. When discussing broadly with the counterparts responsible for the OE theme in each department, some inadequacies were noted. Therefore the team offered a suggestion to contemplate this issue.

Overall, the management of the feedback of the operating experience is well managed, with visible commitment from the vast majority of the staff of the plant.

### 6.2. SOURCES OF OPERATING EXPERIENCE FEEDBACK

Penly NPP receives external information from other French plants via the corporate office in Paris. At EDF, the group CID –(*Concertation Inter-Domaines*) selects a series of events, in a weekly basis and forwards this list with some basic information to the plant. The figures of 2003 demonstrate the very large number of events processed by the group CID: more than fifteen thousands events/abnormalities reported into the SAPHIR data bank, as well as 588 reportable events (CRES). Weekly, an average of forty events are reported to the plant, this being the number during the first week of the OSART mission. This source of external events receives an initial pre-selection by the OE Coordinator and this selection is sent for

processing into the departments. During the first week of the OSART mission, sixteen events were selected to be analyzed. The team noted some areas for improvements and offered a suggestion to the plant in this area.

The group CID is also responsible for the analysis and selection of the international events to be sent to the plants. In 2003, an average of 300 events were selected from the WANO database and eleven (11) were sent to the plants suggesting corrective actions.

There is no specific organizational unit at the plant to control the process of dissemination of the international events. There is no feedback from the plant to the EDF Corporate on the status of the recommendations. Most of the recommend actions come from the WANO documents Significant Operating Experience Report. The team encouraged the plant that follow-up of the corrective actions should be considered with priority.

WANO data bank is the most important source of international experience used by EDF, and at Penly it is easily accessed via the plants Intranet. Indeed Penly was the leading French plant to incorporate the free access of the WANO data bank in the plants Intranet, and this fact should be commended. However, there is no consensus among the departments on the necessity and the potential added value to them from the use of the WANO OE data bank. The team believes that the plant management should consider the promotion of the use of the WANO OE data bank among the plant personnel.

### 6.3. REPORTING AND SCREENING

At Penly NPP, the first step to initiate the identification of a potential event may come from anyone at the plant, during his/her normal routine work, basically through the filling in of “deficiency sheets”, named “Fiche d’Ecart”. This sheet is simple, with basic information on the abnormality and is sent to the department to evaluate and classify its importance. There are other sheets, more or less specific to individual departments and some also use the “Fiches du Progres Permanent”.

One of the most significant and important means to report plant abnormalities comes from the management action of its presence in the field. The procedure *SPE 084 – Presence Terrain*, establishes the instructions to collect and record any findings. More than one thousand registers have been recorded this year of 2004. Basically, this means of reporting is the principal one to report low level events and near misses.

The Technical Support department uses a very comprehensive and simple process to register near misses and low level events during the routine work of its personnel. The document used is named “FIRS”, that could be understood as “nuclear and industrial safety risk identification sheets”. The route used to process the FIRS is simple: the detection and the register of the abnormality, his/her suggestion to correct the situation. Then this document is analysed in an internal weekly meeting and the information is passed to all technical personnel of this department.

The document is further discussed in the departmental meeting for further more significant processing. This process is simple, and user friendly and the plant is stimulated to convey its use by all departments.

Finally, all these data are fed into the SAPHIR data bank, the powerful tool used by EDF to collect information from their fleet and to share the operating experience among them.

The data imputed by Penly is one of the highest in number and quality, compared to other NPPs. Information from Significant Events, as well as the information from minor events and abnormalities is fed into the SAPHIR database. Around one thousand of occurrences were imputed in 2004 by Penly NPP, being basically twenty six from significant events and the rest from minor occurrences and abnormalities. However, information from local events, with more importance than the lower level events is not evenly and regularly being imputed among the departments. The team offered a suggestion to the management to counteract this situation.

#### 6.4. ANALYSIS AND TRENDING

Significant events (CRES) are analysed and trended, using guidelines developed by EDF Corporate. The department SEQ follows closely all intermediate steps related to preparation, approval and processing of the CRES. Basically CRES are divided into four categories: safety significant for operations, environmental related, radiological protection related and events related to transport of radioactive materials. As it was said before, twenty six significant events were registered in Penly in 2004. Due dates to the Regulatory Authority are strictly followed. The average time span, for 2004 was 55 days (60 days is the due time frame).

During the meeting of Committee REX all events, local and external are discussed and is conducted by the OE coordinator. Although this meeting receives a very high priority by the Plant Manager, such that he himself chairs the meetings, some organizational units are routinely not present, what demonstrate that somehow that high priority is not shared by them.

Seventeen meetings have taken place this year of 2004, with sufficient quorum. But some significant absenteeism was observed: one department was absent sixteen times, some others were absent more than half of the meetings. The document *SPE/104 – General Organization for the Feedback of Operating Experience*, establishes the minimum quorum of fifty percent of the eleven organizational units participants of the Committee REX meeting. But nothing is said about absenteeism or minimum attendance frequency. The team encourages the plant to further foster and promote the importance of this meeting into all departments, clarifying the administrative procedure accordingly.

The department SEQ conducts several actions to promote and assess the safety at Penly NPP: every six months there is a meeting from the Groupe Technique de Surete (GTS) or simply safety technical group, with compulsory attendance of all department heads, chaired by the Plant manager; annually a detailed report is prepared – *Bilan Annuel de Surete* and every two weeks, a specific meeting takes place to discuss related human and organizational factors derived from CRES and from the results of the management field plant visits, the so called CPOH meeting.

In this meeting challenged barriers named ‘lines of defense’ are discussed. Basically, Penly NPP created these lines of defence to define and list the findings from management presence in the field. This inventory is a typology of all the various defence levels at the plant such as design of facilities, availability and performance of equipment, systems lay out, means of intervention, quality of documents, organizational team, planning of activities, skill level of workers, relevance of controls, use of experience feedback, and others in number of twenty five barriers. Facts and findings can therefore be characterized on the basis of their positive or negative impact on one line of defence. They give the plant various insights into safety performance levels that are complementary and comparable and are reviewed on a regular

basis by various plant bodies. These characteristics help to enhance the safety performance assessment at all management levels.

The lines of defence approach and the meeting CPOH were considered as good practices by the team.

## 6.5. CORRECTIVE ACTIONS AND USE OF OPERATING EXPERIENCE

At Penly NPP, there is no centralized control of the status of the implementation of corrective actions. This control is done individually in the departments and for the significant events, the department SEQ does that in addition to the control performed individually by the departments, what assures one related second barrier. SEQ also warns the departments when the due dates are to be reached. This approach demonstrates the commitment Penly NPP has on the safety awareness.

Information about the events shall be shared among all professionals related or affected by the events. However, the existing control process on lessons learned from Significant Events does not warrant that all technical professionals from different departments receive the required safety related information. This is especially worrisome applicable to the control room operators. It could be found that the operating crew (as a team) received the required information, but no assurance could be found that the individual operator from the crew received this information, since that, due to any kind of absenteeism, sickness or vacation, he or she could have missed the required training or information. It was also verified that similar situation exists in other departments, as well. The team offered a suggestion in this area.

Another point to emphasize in a continuous learning organization is the existence of a process to verify the adequacy or the effectiveness of the recommended corrective actions. At Penly NPP, the effectiveness of the corrective actions taken to address the causes of the events is not regularly and formally pro-actively assessed. Significant and local events (CRES and CREL) have considerable number of corrective actions taken to correct the causes and avoid re-occurrences, but there is no formal process for assessing their effectiveness. International experience demonstrates that the effectiveness of the corrective actions should be periodically assessed. By doing this, methods are developed and implemented, to verify how effective the implemented corrective actions were, in preventing reoccurrences and similar events. The team offered the plant a recommendation in this area.

## **PENLY FOLLOW-UP SELF ASSESSMENT**

Penly's contribution to event-based OE improved in 2005. When compared with other sites, we feature among the top performers of the French nuclear fleet.

However, the OSART mission revealed that there was still room for improvement with regard to the site's goals, in order for it to meet best international standards. This is why we have strengthened the actions taken to coordinate and monitor the OE processing system.

During this period, our efforts in this area essentially focused on:

- ✓ formalising and complying with requirements for the processing of local event reports (meeting analysis deadlines, corrective action record-keeping, meeting action processing deadlines).
- ✓ improved coordination in the processing of external event-based OE

These actions fall within the scope of the continuous improvement programme and help to develop and perfect the OE processing system. In this respect, year 2006 will serve to consolidate results already achieved.

In 2006, the monitoring of significant event corrective action effectiveness has entered its operational phase. Drawn up at the end of 2005, the actual implementation of this monitoring process has been approved by the Safety Technical Committee. The applicability of its methods will be reviewed at the end of 2006. This will help to overcome one of our greatest weaknesses, i.e. failure to close the OE processing loop with regard to the relevance and sustainability of corrective actions.

Thanks to the initiative of one department, year 2006 saw the implementation of a “trial” training course on the basic principles of event analysis and OE coordination. Owing to the satisfaction expressed by staff, this training will be offered to all crafts involved in the process.

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

In summary, the team concluded that the plant did a very good job in addressing each of the issues in the OE area. Local event analysis is being done very well, with the appropriate effort by senior management to ensure its effectiveness. Corrective actions are being closely monitored through the use of performance indicators, which ensure timely processing and control.

Significant events are being disseminated to all operations staff, given their significance and urgency. Senior management committees are established to ensure events are properly prioritized and analyzed so as not to overload operations staff with information. The team concluded that the plant did a good job of organizing the work of the Safety Technical Committee so as to provide enough flexibility for this committee to function effectively in the area of OE.

## DETAILED OPERATING EXPERIENCE FINDINGS

### 6.1. MANAGEMENT OF OPERATING EXPERIENCE FEEDBACK

**6.1(1) Issue:** Local Events reports are not receiving the necessary attention warranted by their importance and significance.

Local Events (CREL) are the ones not considered Safety Significant Events by EDF guidelines; their co-ordination rests with the Operating Experience (OE) Manager. In 2004 eighty events were classified as belonging to this category. The Group CREL has one exclusively dedicated professional for this task. When discussing with them and with counterparts responsible for the Operating Experience theme in each department, several facts have been verified:

- Local events are analyzed by each individual department. There is no standard procedure or guideline to be followed to process a CREL. The format and the contents follow some pattern, but it is not consistent among the departments. There are CREL that have due dates for the corrective actions and others leave these dates open.
- The OE Manager has no timely information on the status of the recommended corrective actions originated in the CREL; because the OE group depends on the feedback from the departments on the status and there is no priority in the department to feedback this information to the co-ordination group.
- To illustrate this assertion, in 2004 approximately forty seven percent (38 out of 80 events ) have not been fed back on their status to the co-ordination group.
- There is no formal procedure or instruction that establishes the timeliness for the Departments to report the status of the CREL.
- The indicators used to monitor the efficiency of the CREL process are consequently not very precise.
- There is no formal commitment to inform the plant staff of the lessons learned from the CREL, through the Training department or any other means.
- The experience and lessons learned from Local Events (CREL) is not regularly fed to the SAPHIR data bank and as such, this experience is not shared with other French nuclear power plants, via this powerful tool, managed by the EDF Corporate.
- The data bank named SAPHIR is EDF's source of information related to abnormalities and lessons learned to all EDF fleet. This data bank receives information from all NPP's in France.

Without a sound process to process the Local Events, there is a probability that, the lessons that certainly could have been learned from them would be missed, and consequently re-occurrences may take place.

**Suggestion:** Consideration should be given to enhancing the process of analyzing and reporting of local events, establishing clearly defined guidelines including responsibilities, accountabilities, timeliness and performance indicators.

**Basis :** IAEA Safety Report Series 11, sec. 5.3; NS-R-2, para 2.21.



## **Plant response/action:**

The site has taken great pains **to formalise the process whereby local events are analysed and processed.**

**An instruction manual** (GT/IN. 007) sets out all process requirements and **criteria for drawing up local event reports** (CREL)

It focuses on the following points:

- ✓ Event analysis and report completion deadlines set at 2 months
- ✓ Roles and responsibilities of managers and crafts in the detection, documented analysis and monitoring of corrective actions (record of action sheets in the CREL and completion deadline, systematic discussion of CREL at OE committee meetings)
- ✓ Formalities for notifying the OE coordinator
- ✓ Management indicators

Two types of document are used, depending on event content:

- ✓ Simplified local event report (the most frequently used)
- ✓ Local event report, with a similar structure to that of the significant event report used for in-depth investigation and including a human factor analysis.

Process management has been improved by the establishment of several indicators based on craft responsiveness to event analysis (target: deadline < 2 months) and to processing corrective actions by meeting the deadlines they set themselves (target: number of CREL action sheets failing to meet deadline < 5 %).

Implementation of the process was stepped up in the second half of 2005 by the Technical Director during his OE committee chairmanship period:

- ✓ Local event analyses are systematically discussed by the OE committee, who monitors the process by providing a critical and cross-functional appraisal of analysis quality and the relevance of adopted corrective actions, while also involving the various departments in these investigations (ownership). It identifies and highlights actions that could potentially be earmarked as good practices.
- ✓ Depending on OE relevancy, the committee decides on whether to disseminate the investigation in the corporate SAPHIR OE database. CRELs are therefore not systematically recorded in SAPHIR.
- ✓ CREL discussion dates are scheduled.

Year 2006 will focus on consolidating integration of analysis requirements and corrective action processing requirements.

The effectiveness of corrective actions associated with local events will be measured once the significant event corrective action review process currently underway has been tried and tested (early 2007).



**IAEA Comments:**

The plant has indeed taken good measures to address local event reporting and analysis and has engaged senior management in the appropriate areas. The actions taken to address this issue appear to be well constructed and should prove valuable to the plant in the long term. The involvement of the OE Committee to look at cross functional areas involving various departments is a strength. Integration with human performance tools should also prove valuable in the long term. The plant is encouraged to continue its progress in this area, as this issue is a long term catalyst for continuing improvement.

**Conclusion: Issue resolved.**

## 6.2. SOURCES OF OPERATING EXPERIENCE FEEDBACK

**6.2(1) Issue :** The in-house approach to the processing of the external event reports does not follow plant policy and procedures.

External Events are the ones processed by EDF Corporate, by the Group CID. A selection of an average of forty to fifty events are sent weekly to Penly NPP for analysis and some few for implementation of important corrective actions. At Penly they are received by the OE Group. Every week, on Monday, the responsible person receives the list with a short description of these events. He does a pre-analysis and selects some of them that are sent to the Departments for deeper analysis and processing. Some require corrective actions to be implemented. During the first week of the OSART mission, sixteen of such events were selected. When analyzing the entire process of these reports, the following facts have been seen:

- The OE co-ordination group has no easy or immediate response on the status of the recommended corrective actions originated from the external events; because they depend on the feedback from the departments on the status and there is no priority in the department to feedback this information to the co-ordination group.
- In 2003, eight events and in 2004 eleven events were not analyzed or have not been feedback to the Co-ordination group on the status of the corrective actions.
- There is a formal procedure PR 14 *Gestion du progres permanent et du retour de experience* that establishes the timeliness for the Departments to report the status of the CREE; however some departments do not follow the requirements.
- The indicators used to monitor the efficiency of the CREE process are consequently not very precise.

Without adherence to well developed policy and procedures to process the external events, there is a probability that, the lessons learned from them would be missed, and consequently re-occurrences may take place

**Suggestion:** Consideration should be given to reinforce full compliance to the existing administrative procedure PR 14, ensuring that all departments comply with the existing requirements. By doing so, related performance indicators to monitor the process will be a more reliable tool.

**Basis:** IAEA Safety Series NS-R-2, para 2.21; Safety Service 10: PROSPER Guidelines, sec. 7.III.1a, 7.VI.1d

### **Plant response/action:**

Actions have focused on the **reinforcement of PR 14 process requirements** (“coordination of continuous improvement and experience feedback”) by OE committee management.

✓ External events selected for analysis are reviewed by the crafts and discussed at OE committee meetings, in accordance with predefined schedules and deadlines. Events with analysis backlogs are listed in OE committee meeting minutes and chase-ups are recorded. These events are systematically re-discussed at the next OE committee meetings. In the event of more than 2 chase-ups, the plant senior management representative is notified so that managerial action may be taken with the department in question.

At the same time, process management has been strengthened by means of 2 trending indicators:

- ✓ the first relates to analyses lagging behind their completion deadline for discussion at the OE committee meeting, as well as their recurrent lateness;
- ✓ the second relates to the meeting of deadlines for processing corrective actions resulting from event analyses.

Both these indicators underwent a trial period in 2005 and have been up and running since the beginning of 2006.

**IAEA Comments:**

The plant adequately addressed this issue by focusing adherence to PR 14 process requirements. The new initiative of establishing two trending indicators is a good effort to ensure corrective actions resulting from event analysis are processed in a timely manner. The plant is encouraged to integrate the continuous improvement and experience feedback results into the human performance improvement program.

**Conclusion: Issue resolved.**

## 6.4. ANALYSIS AND TRENDING

- 6.4(a) Good practice:** Use of Lines of Defence to assess and coordinate plant performance  
Penly NPP created lines of defence to define and list the findings from management presence in the field.

This inventory is a typology of all the various defence levels at the plant (design of facilities, availability and performance of equipment, systems lay out, means of intervention, quality of documents, organizational team, planning of activities, skill level of workers, relevance of controls, use of experience feedback, HR management, etc). Facts and findings can therefore be characterized on the basis of their positive or negative impact on one line of defence. Facts and findings may come from experience feedback (SOERS, plant local events reports, low level events, inspections by the Quality Assessment Dept., findings from Safety Authority, findings from management field visits). They give the plant various insights into safety performance levels that are complementary and comparable and are reviewed on a regular basis by various plant bodies.

All organizational unit managers have been trained on the use of this simple tool shared by all departments. It helps to characterize all types of findings from all experience feedback sources. These characteristics help to enhance the safety performance assessment at all management levels (teams, departments and NPP) by comparing the various operating experience sources. Eventually this tool allows to analyze and monitor the quality of management tours in the field and to focus field tours on the weakest lines of defence. Trend monitoring has demonstrated the efficacy of the coordination of management presence in the field. This tool has helped to target areas for improvement (e.g.: risk analysis) and reverse the nature of negative findings on the corresponding line of defence.

- 6.4(b) Good practice:** Establishment of the Human and Organizational Performance Committee (CPOH)

The plant decided to create the CPOH, an intermediate body between the department's event management committee and the plant's event management committee. This body gives the plant's event management committee a thorough analysis of the most vulnerable lines of defence and also puts forward comprehensive actions to widely share experience, with all disciplines, on issues identified on the field and their solutions as well as on good practices. The plant manager chairs the CPOH; its secretary is the human factors consultant. It is an extension of the plant's OE committee, whose task is to crosscheck different sources of OE.

The CPOH includes plant management team members such as the plant manager and the nuclear safety advisor, as well as all plant disciplines. It is therefore a real opportunity to share experience to reinforce the 25 lines of defence and acts as a forum to discuss all factors challenging the defences.

## 6.5. CORRECTIVE ACTIONS AND USE OF OPERATING EXPERIENCE

**6.5(1) Issue:** The existing process control on lessons learned from Significant Events does not ensure that all technical professionals from different departments receive the required safety related information.

The information transmitted to the licensed operators with the lessons learned from the significant events is done via two mechanisms: a) during the period of the simulator training (two times per year, during one week) and b) via direct control of the operations department.

This year of 2004, twenty six significant events (CRES) took place at Penly and ten of them had direct impact on the operations of the plant, and as such were classified as compulsory information to all licensed personnel. However, the team noted that training records for each individual required to receive the training were not retrievable, only crew training.

Without this information, some operators could miss important safety related information and re-occurrences might take place.

**Suggestion:** Consideration should be given to revising the existing control process to assure that all personnel from the shift crew receive the required information and that the training records are retrievable.

**Basis:** IAEA Safety Guides NS-G-2.8 sec. 4.45

### **Plant response/action:**

Staff safety culture is a priority of the Penly operations department. Each event, whether it be internal or external, can potentially be used to improve individual and collective knowledge. However, it is essential to be able to identify relevant information in order to avoid putting out too many messages and run the risk of failing to highlight fundamental aspects of plant operation.

It is with this unflinching determination to convey clear, effective and safety-culture enhancing messages that the operations department analyses various types of event.

At plant level, **every outage is preceded by a compulsory training course** which reviews the main aspects of the coming outage and potential modifications, as well as providing a summary of OE from previous outages. Prior to the outage, this training course is also an effective means of enhancing knowledge regarding sensitive activities. By way of an example, events that occurred during the 2005 outages will be presented to avoid repetition during the outage in 2006 (and so on for the following periods).

Furthermore, the Penly operations department has decided to implement an “**infrequent activity tracking programme**”. Every year, a limited number of infrequent activities conducted by a given craft is identified (on the basis of topical plant-specific, corporate or international issues) and every department member is expected to have experienced the situation, either in real life or as part of their training. As part of this infrequent activity tracking programme, a chart of staff members having attended the training is kept up to date.

For example, the subjects identified for control room operators are ‘criticality’ (corporate operating experience, criticality event at Fessenheim NPP), and ‘collapsing the bubble’ (plant operating experience, event occurring on 30<sup>th</sup> September 2005). At corporate level, simulator training incorporates major events in order to raise the general level of control-room operator knowledge (example: operating experience from Fessenheim NPP).

It is also worth noting that in addition to this form of adapted training, a system is used to **prioritise and streamline information concerning operations crews**. Information about key events is communicated via the plant operating experience process.

When information comes in with regard to an event occurring outside the department, or when corrective actions are devised in response to a safety-significant event involving the operations department, the event is analysed by the operations department. Communication arrangements are then determined on the basis of the three following principles:

**Event with high safety stakes** requiring formal communication guaranteed to reach the people involved (e.g. all control-room operators). In such an instance, a support document is drawn up and given to team managers to help them enhance the quality of the discussion. Individual attendance is tracked and the discussion is assessed in terms of completeness.

**Event requiring specific information.** For this type of event, a support document is also drawn up by the operations department. This document is used for team discussion. These documents are made available to all department members in the on-line operations forum. Dissemination of this information does not have to be tracked individually, as the issues at stake are not so serious as to require verification of attendance. However, all information is made available and the role of the team’s OE coordinator is to promote an individual approach.

**Event of interest to department staff.** In such an instance, information is conveyed via the incoming OE file. This file is administrated as part of the OE set-up run by the operations department’s procedures group. There is no formal support document, nor any obligation to track the dissemination of information.

## **IAEA Comments**

The team agrees with the approach taken by the operations department for training operations staff on significant events. The team was impressed that consideration was given to address the area of safety management and safety culture. The infrequent activity tracking program will strengthen the plants ability to conduct required training and appears an excellent tool to prioritize and streamline information, so the proper focus can be given with the amount of valuable operations time available.

**Conclusion: Issue resolved.**

**6.5(2) Issue:** The effectiveness of the corrective actions taken to address the causes of the events is not regularly assessed.

Significant and local events (CRES and CREL) have considerable number of corrective actions taken to correct the causes and avoid re-occurrences. The Service de Evaluation de Qualite – SEQ and the individual departments are the responsible organizations for tracking the corrective actions taken. There is no formal process for assessing their effectiveness. International experience demonstrates that the effectiveness of the corrective actions should be periodically assessed. By doing this, methods are developed and implemented, to verify how effective the implemented corrective actions were, in preventing reoccurrences and similar events.

The annual formal report from the plant to the Directive DI 50 is a comprehensive document that assesses all important safety related issues, including the classification of the corrective actions by groups of common similarities. However, it does not include the evaluation of the effectiveness of the corrective actions implemented.

Without an approach to verify the effectiveness of the implemented corrective actions, re-occurrences and or similar events with common causes may take place.

**Recommendation:** The plant should implement a process to verify periodically the effectiveness of the corrective action programme originated by significant and local events.

**Basis:** IAEA Safety Series NS-R-2, para 2.21; IAEA documents INSAG 4, sec. 4.2.2.3, Safety report series 11, sec. 5.4 and 6.4.2, Safety Service 10: PROSPER Guidelines, sec. 7.VI.1e

#### **Plant response/action:**

Inspired by a practice identified abroad, the site has devised a **process** for reviewing the effectiveness of corrective actions **associated initially with significant events** and endorsed by the Safety Technical Committee (GTS).

▶▶ The method associated with this process is based on a set of questions designed to challenge the actions implemented for each event. The process is conducted by department management once the corrective actions have been established and implemented. It focuses on the integration of corrective actions (implementation on the ground, staff knowledge and understanding, updating of documents) and on their actual effectiveness reviewed not only from a staff and working methods perspective, but also on the basis of OE data and equipment performance.

To begin with, the questionnaire has been tried out on a number of events in order to ascertain its relevance and feasibility.

▶▶ The system uses existing structures. The Safety Technical Committee is used in order to monitor and validate this “effectiveness review”. This consequently enhances the performance of the Safety Technical Committee as the process enables the effectiveness of adopted corrective actions to be monitored on an ongoing basis.

Furthermore, the process helps to optimise decisions taken by the Safety Technical Committee whose job it is to validate corrective actions put forward in significant event reports, by reinforcing ownership of corrective actions deemed to “effective”.

»» The maximum number of effectiveness reviews has been set at 2 per significant event: the aim of the first one is to review corrective action effectiveness; the aim of the second is to review not only the effectiveness but also the sustainability of these actions over time.

»» The process (system and questionnaire) is described in document SPE121 “Effectiveness review of corrective actions implemented following safety-significant events.”

»» The process has been approved by the Safety Technical Committee for implementation as of 2006, with retroactive implementation for significant events having occurred in 2005 and having been caused by line-up errors, violation of technical specifications or a reactor trip. It will be looked at again by the Safety Technical Committee after a one-year implementation period in order to validate method applicability and to assess results.

»» The process will be extended to include local events once the significant event process has been tried and tested.

»» GTS meetings for the appraisal of initial effectiveness reviews have been scheduled for April and June. Administrative aspects associated with review appraisals will be handled by human factor representatives from the quality department.

#### **IAEA Comments:**

The team concluded that the plant did a good job of evaluating this issue and of taking the appropriate actions. The Safety technical Committee is taking a well structured approach to look at the effectiveness of corrective actions. The implementation period of 2006 should demonstrate the effectiveness of the new questioner and the overall process of assessing the effectiveness of the corrective action program.

The plant is encouraged to extend the results of this effort into the integration of the human performance tools currently being applied and to continue to instill ownership of the effectiveness of the OE process at all levels in each affected department.

**Conclusion: Satisfactory progress to date.**



## 7. RADIATION PROTECTION

### 7.1. ORGANIZATION AND FUNCTIONS

#### Functions and Responsibilities

The Prevention and Radiation protection service (SPR) seems to be managed in a very structured way. The functions within the service are well defined. There seems to be willingness on the part of management to accept and take its responsibility. The people appear to be relaxed and proud of their realizations.

There are open contacts with the advisor (chef de mission) on radiation protection and environmental matters, who is in charge of the supervision of the implementation of the regulatory requirements and who is reporting to the plant manager on these aspects.

There is good communication with other services, through the daily work, the common assessment of projects, the trainings and the quarterly Technical Group on Risk Prevention (GTPR).

It must be observed that the responsibilities related to overall radiation protection surveillance are split over many services and functions : the SPR for the occupational radiation protection and mainly the Technical Service (TS) for environmental radiation protection issues (effluents). The advisor on radiation protection and environment has a 'horizontal' function for the surveillance of the application of the regulation and the reporting to the plant manager on these issues.

Although this organization structure is compliant with the actual regulatory requirements, it is not clear which person(s) has or have the role of 'qualified expert' in terms of the IAEA Basic Safety Standards (IAEA BSS - Safety Series 115, paragr.2.31-2.32).

A new French regulation on qualified experts ('PCR' or 'Personnes Compétentes en Radioprotection') that is derived from the European Directive 96/29 Euratom has been issued in 2003 but not yet implemented, as there are still no bodies that are accredited in France for the certification of PCR's. This regulation is focused on the expertise in *occupational* radiation protection. Nevertheless an exercise is performed at the National level in order to identify all functions within the EDF plant organization structure that are related to radiation protection and to define the respective qualification requirements.

#### Radiation Protection Performances

Radiation protection indicators are set up to follow the performances in the field of external exposures and the detection of external contaminations. Goals are defined on a yearly basis. In the same way indicators and goals are set related to the release of liquid and gaseous effluents. The Penly plant management gives a relative high importance on the communication of these indicators.

## Radiological Events

Significant events are traced according to an EDF methodology on an 'ESR' database (Significant Radiation protection Events). The events are analyzed and addressed in the management review. In a same way, the environmental events and the transport events are treated respectively in the 'ESE' and the 'EST' databases.

Besides this, the SPR has created a database called 'incident library' (*incidenthèque*), for the grouping of the OE of smaller events at Penly and on other EDF plants. This database looks very practical to be used, e.g. when risk assessment is made in preparation of interventions.

The team decided to emphasize the design of the 'incident library', by mentioning it as a good practice [see good practice 7.1(a)].

## Operational Procedures

The procedures, instructions, forms, reports and other documents addressing radiological issues are elaborated with a high quality level. The information is precise and clear.

Related to the drafting of new documents, especially new prescriptive procedures, the SPR has set up a system called '' (*boucle d'application*). The idea behind is that procedures are better linked with the reality, the practices and the experiences in the field. The system consists of a three steps iterative approach : first an evaluation on the basis of in the field visits, second an information campaign once the document is issued, third a checking of the application in the field once the procedure is implemented.

This initiative is stimulating the in the field presence of the middle level management and for this reason the team decided to report the 'implementation loop' in developing procedures as a good practice [see good practice 7.1(b)].

## Radiation Protection Training

For access to controlled areas the French Authorities are requiring a RP1/RP2 qualification, which assures the basic knowledge on radiation hazards and protection measures.

Besides this and other general training programmes, EDF has set up a Local System for the Development of Skills (SLDC) programme to increase skills on the field. This seems to be an interesting iterative approach whereby shortcomings are first identified by a field review followed by small and focussed trainings organized to improve skills.

In the SPR one person is responsible for the 'SLDC-RP'. Investigations were done and about 15 trainings were given this year by the SPR according this programme. Additionally, information is spread during meetings. An example is the training related to access rules to red zones (zones with a significant radiation level), that was given to SPR staff and to the plant senior management.

An environmental management system according to the ISO 14001 standard has been set up. Penly was the second French NPP to get the certification, in 2002. The system is dynamically managed and pays a lot of attention on information, communication.

Over the last years the actions were focused on the compliance with new environmental regulatory requirements for nuclear installations, issued in 1999.

## 7.2. RADIATION WORK CONTROL

### Radiation Work Authorization

In the frame of the OSART mission the ‘radiation work authorization’ was investigated in the larger context of ‘work authorizations’, including both the assessment of radiological risks and the assessment of ‘conventional’ risks, as this is a current practice today.

For each intervention in the controlled area there is a specific permit. For interventions in orange or red zones with higher radiation level, there are extra requirements that must be fulfilled. There is also a specific registration of these interventions.

The work authorization is based on an estimate of the dose assessment and a preliminary risk assessment in the form of a checklist for the assessment of some conventional aspects related to the intervention.

Related to the dose assessment, a radiation risk level is allocated (N1, N2, N3 or N4) on the basis of a preliminary dose estimate. Each level consists of three maximum allowed exposure parameters: individual dose, collective dose and dose rate. In a second step an ‘optimized’ dose assessment is made, that takes into account the preventive measures that are taken (e.g. shielding) and the measured dose rates on the work area. The measures are defined in order to reduce the doses are based on the experience feedback of Penly plant and other plants, EDF ALARA sheets, good practices sheets and other inputs.

On the other hand, the preliminary checklist for the assessment of conventional risks is sometimes completed, in other cases it is replaced by other risk assessments, performed either by EDF personnel, or by the contractor. It seems that there are several methods in place, that several approaches are followed.

In the field, both in controlled areas as in non-controlled areas, a specific ‘site sheet’ (*‘panneau de chantier’*) is in use. This sheet summarizes information related to the work site, with the focus on the risks and prevention measures for the on-going intervention. The sheet is put close to the workplace. For some more complex works an ‘intervention plan’ (*‘plan de qualité’*) is established, with a stepwise definition of the measures to be taken.

Nevertheless, it comes out that there is no evident link between the various dose and risk assessments that were performed and the information available in the field. As it is essential that the information deduced from the assessments be passed to the people on the work area, the team decided to make a suggestion on this topic [see issue 7.2.(1)].

### Control of Radiological Areas

The controlled area is divided in green, yellow, orange and red zones depending on the radiation dose rate. This is a regulatory requirement. This color labeling is clearly present at the entrances of all the rooms, mostly combined with the new (standard) panel identifying the risks. On the same label it is also marked if hot spots are present in the room.

According to the EDF policy, hot spots (*'points chauds'*) are defined as locations with a dose rate exceeding 2 mSv/h and more than 10 times the ambient dose rate of the room. The SPR set up an action plan for enhancing the management of hot spots within the controlled area (about 15 hot spots identified per controlled area). The registration is done in a systematic way, trends are analyzed and initiatives are undertaken to prevent them. For their prevention, preference is given to the cleaning of the circuits, above simply shielding. This is the most sustainable approach.

For this reason the approach was selected as a good practice by the team [see good practice 7.2(a)].

However, attention should be kept to areas with significant dose rates but lower to what should be strictly considered as 'hot spot' according to the EDF policy. As there is only a warning at the entrance of the room, especially for big rooms it is not straightforward where the area of concern is located. In some cases an extra signalization could be helpful.

It should also be noticed that the indications on the labels are sometimes in  $\mu\text{Sv/h}$ , sometimes in mSv/h. Although this is a current practice, this may lead to confusion.

Since a few years EDF gives a high priority on 'radiological cleanliness', in order to avoid the unnecessary spread of contamination in (and outside) the controlled areas. Actions were undertaken at Penly in order to 'recover the radiological cleanliness'. In particular the controlled area entrances with locker rooms were completely re-organized in order to avoid cross-contaminations. These actions gave positive results: over the last two years the number of detections at the exit monitors could be drastically decreased.

In this way EDF prescribes also to divide controlled areas in NP ('clean') zones, N1 zones and N2 zones, according to the contamination hazard. Actually there are still indications of B and C zones in the controlled area, according to the former ephemeral methodology.

The same policy allows for a 'declassification' of controlled areas, in order to limit the waste production. These areas can be still controlled areas as there is still significant radiation, but the contamination risk is negligible. Before declassification experience must show that over time no significant contamination was detected in these areas. These areas will be called 'K zones' (or 'D zones' in the former methodology).

The system seems rather complex and there is matter for confusion. Each plant will be free to define its K, NP, N1 and N2 zones according to its 'cleanliness' strategy.

The general impression is that signalization related to the radiation hazards is meticulously done at Penly. Nevertheless and as stated above, there are still areas for improvement or simplification and the team decided to make some suggestions on this topic [see issue 7.2(2)].

### 7.3. RADIATION DOSE CONTROL

The necessity for an ALARA approach was well embedded within the services that were interviewed. The different actors were proud of several of their realizations that could lead to dose reductions.

Quite detailed assessments are undertaken on the basis of dose registrations during interventions. However, the corrective actions or at least the suggestions for improvement that should be defined in the case of a dose increase are sometimes missing.

#### Internal Dose Control

The potential internal exposures is controlled and followed by the medical service according a well-defined approach, that takes into consideration both scientific as human (psychological) elements. The approach is also extraordinary 'open'.

The systematic approach applied by EDF and more precisely the Penly medical service in this field could serve as an example. For this reason the team decided to mention this as a good practice [see good practice 7.3(a)].

#### External Dose Control

The external dosimetry is based on electronic dosimeters for the mandatory dose follow-up and passive dosimetry for the official dose registration.

The electronic dosimeters are provided at the entrances of most of the controlled areas, and for these areas there are automatic control gates at the entrance and the exit. Nevertheless attention should be paid that within 'smaller' controlled areas without control gates the electronic dosimeter is also effectively worn.

The passive dosimeters are film badges for EDF staff. Contractors or other externals must confirm that they are also in the possession of a passive dosimeter. But there is no check of the passive dosimeter at the controlled area entrances.

The electronic dosimetry is followed by the EDF application MICADO, which is centralized in SPR offices. The application allows investigating cumulated doses, abnormal high doses or anomalies in the dose registration. The passive dosimetry is registered by the plant physician in DOSIREG. If deviation between passive and electronic dosimetry is observed, the physician asks for an inquiry. For EDF staff and externals there is a centralized national database DOSINAT.

Although it is still not implemented in the French regulation, EDF already applies a dose limitation at 20 mSv per year, with several warning thresholds to assure that this level should not be exceeded.

#### 7.4. RADIATION PROTECTION INSTRUMENTATION, RADIOACTIVE SOURCES

The fixed radiation monitoring instrumentation is managed by different services, but there is a document defining the different responsibilities. The maintenance and verification programme is correctly done according to current practices.

The portable radiation instrumentation is managed by the SPR. The follow-up of the location where they are in use, the periodical checks and the maintenance and repairs is done in a very structured way with the computerized application GEMO.

The periodical verifications are subcontracted. For this reason the SPR has set up a programme for a random check of the verifications performed on the devices. During the OSART mission some random checks were also performed. No deviations were observed.

An excellent initiative, worthwhile to notice as good performance, are the sheets that were developed by the SPR ('fiches reflexes') and that are summarizing on one to a few A4 pages the 'users guide' of the instrumentation. These sheets are prepared to be handed to users who are not familiar with some of the portable equipments, without embarrassing them with a whole manual.

### Management of Radioactive Sources

As a result of anomalies that were found in other EDF NPP some years ago, EDF has set up a programme to pursue a more rigorous management of radioactive sources. The regulatory requirements related to the management of sources have been translated in plant specific rules. A computerized application, called MANON (... des sources), was developed for the accountancy of both sealed and unsealed sources.

This national EDF incentive to improve the situation has been followed thoroughly at Penly, with a clear wish to reach a high level of meticulousness, both for the accountancy of the stored items as for the trackability of sources in use. The efforts done to keep the radioactive sources under control in a sustainable way should be mentioned as a good performance (a good practice on this topic was already identified at the OSART mission in Nogent NPP, 2003).

## 7.5. RADIOACTIVE WASTE, MANAGEMENT AND DISCHARGES

### Radioactive Waste Management

The management of the radioactive waste is one of the tasks of the Miscellaneous Operational Service ('SMO'). Two main waste streams are identified : the 'process waste', mainly produced by the treatment of effluents and the 'technological waste' (other wastes). The waste from the different controlled areas is transferred to the BTE building, where it is packed in plastic drums, metallic drums, containers or concrete shells, depending on the origin and radiation level. The radiological characterization of the waste is done on the basis of a scanning of the packages with portable gamma monitors (FAG). This relatively simple methodology is prescribed by EDF and approved by the National Radioactive Waste Agency, ANDRA. Once packaged and characterized, the very low level waste containers are transferred to two container parks outside the building, awaiting their shipment. The other waste is stored within a hall of the BTE building.

There is a very accurate bookkeeping of the radioactive waste, with not only a description of the item contents but also the location where they are stored. The bookkeeping is kept up-to-date in near real time.

Moreover, there is a strong incentive to try to reduce the inventory of waste packages stored on the site, in particular the historical waste that could not be evacuated as it was not complying with either the ANDRA requirements, either the transport specifications. Especially the number of stored concrete shells was significantly reduced over the last two years. Each year objectives are set related to the maximum amount of stored waste packages.

The team found it worthwhile to report the actions related to the bookkeeping and the evacuation of historical waste as a good practice [see good practice 7.5(a)].

### Waste Reduction Programme

Despite the proper management of the radioactive waste, there is a clear increasing trend in the total production of waste on the site over the last four years. This can be explained by some general waste generating activities: ten yearly outages, refurbishment of the fire protection, a conditioning campaign of resins, etc. On the other hand it should be mentioned that some actions were undertaken over the last years in order to reduce the production of waste : limitation of package materials in the controlled areas, limitation of non dedicated equipment and other materials, training and sensitization.

In the ISO14001 environmental management system the radioactive waste production is addressed. Nevertheless the role of this aspect in the actual system is rather modest. As the ISO 14001 system should be the reflection of the whole environmental policy of the plant, it could have been expected that radioactive waste is treated with a high priority in comparison with other environmental aspects. This observation can be partially explained by the fact that, at the implementation of the ISO 14001 system, priority was given to actions related conventional environmental aspects, as the authorities had foreseen time until mid 2005 to tackle some deviations with regard to the regulation on environmental aspects.

As the ISO 14001 system seems to be very dynamically managed, it could be very helpful that these means are also used as incentive for the reduction of radioactive wastes. For this reason the team decided to make suggestions with regard to the future role of radioactive waste in the environmental policy of the plant, especially with regard to the production of technological waste [see issue 7.5(1)].

### Gaseous and Liquid Effluents

The management of gaseous and liquid releases stays under the responsibility of the Chemistry section within the Technical Service (ST). The approach is rigorous and the measurements are well recorded. The approach is similar to the current practices in NPP.

The release records are transmitted on a monthly basis to the National Authorities. There is also a systematic sampling of the releases that is transferred to the Authorities for crosschecking.

### Environmental Monitoring

There is a well established environment monitoring programme, performed by monitoring stations along the plant perimeter, at 1, 5 and 10 km. These continuous measurements are combined with a sampling programme of air, water (rain, underground and sea), milk and vegetables.

In the same way as the release measurements, the records are transmitted to the National Authorities. There is also a measurement station and a sampling dedicated to the Authorities.



## 7.6. RADIATION PROTECTION SUPPORT DURING EMERGENCIES

Within the emergency organization structure, the radiation protection aspects are addressed in the ‘Local Logistics Emergency Centre’ (PCM), with regard to the protection aspects of on the plant and in the ‘Site Assessment Emergency Centre’ (PCC) with regard to the assessment of the radiological releases and their consequences.

Emergency radiation protection equipment and instrumentation is foreseen at different locations on the site. Random checks in the frame of the OSART mission showed that the equipment was in a good state and that the radiation protection instrumentation was submitted to the overall verification programme. It was observed that there are no protection masks foreseen at the grouping points. It would be worthwhile to investigate the need for it.

As a result of a regulatory requirement in this field, a list is being established of staff members with aptitude and willingness to be selected in the case an intervention is needed that could result in an exceptional exposure. The introduction of this list is combined with specific training on radiological risks.

### **PENLY FOLLOW-UP SELF ASSESSMENT**

In the area of radiation protection, the OSART mission and more specifically the discussions we held with our reviewer, provided us with an opportunity to compare our practices with those of another European country governed by the same rules and regulations, and to review the perceptions we had of them.

In addition, our response to the three OSART suggestions enabled us challenge our practices and adopt a more meticulous approach in the area of radiation protection and radioactive waste :

- ▶▶ Generally speaking, the approach adopted with regard to radiological risk signage helped us to be more thorough in choosing and standardising a single unit of measure: the millisievert. The subsequent use of one “language” should in future help us to reduce the risk of confusion by a factor of one thousand. Our radioactive material shipment containers (waste, equipment, samples and sources, etc.) now bear a trefoil sign indicating the nature of the shipment, which is now optimised in terms of radiological risk and cleanliness. As far as radiological cleanliness in the various buildings and rooms is concerned, signage now complies with our directive, which applies throughout EDF.
- ▶▶ The risk prevention department systematically validates worksite signs which provide a summary of industrial safety/RP risks for every job where there is a risk of contamination. For other worksites, the lead workers – who write up the worksite signs – are supported by their line management and the RP department, who sign off these risk assessments on the occasion of field inspections.
- ▶▶ The issue of radioactive waste in connection with Penly’s environment management system has been highlighted thanks to a set of actions intended to reduce radioactive waste production and to optimise volumes produced during outage or major activities.



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

In the area of Radiation Protection the OSART team made three suggestions. The plant has made a strong effort in response to the suggestions made by the OSART team.

The actions the plant has selected as response to the OSART suggestion related to risk assessment aim to standardize and make more consistent the use of existing methods. The new approach will also call for an independent evaluation in majority of cases of outage works to ensure that risk management for the given work is appropriate.

However these changes to the process of individual industrial hazard prevention have not been implemented yet but are being prepared for application starting from July 2006.

The plant has introduced several actions in order to improve signposting of radiation and contamination risks. Dose rate is now uniformly expressed in mSv/h units what eliminates the potential for any confusion. Hot spots are signposted also in green zones. A new signposting system for contamination risks has been introduced. This was confirmed during the tour of the radiation controlled area of unit 2.

Since the OSART mission the plant has assigned more emphasis to the topic of radioactive waste production in the frame of the environmental management system. Several indicators have been selected to provide a more detailed characterization of the efforts to limit and reduce the production of radioactive waste. It is due to several extra modification and reconstruction activities that the ultimate goal of reducing the amount of solid radioactive waste could not be achieved in 2005.

## DETAILED RADIATION PROTECTION FINDINGS

### 7.1. ORGANIZATION AND FUNCTIONS

**7.1(a) Good practice:** The incident library is the capitalization, processing and dispatching tool for operating experience (OE) within the Prevention and Radiation protection Service (SPR). It is used by the SPR team to inform them on risks and to prepare the responses they are dealing with.

From the OE file for the plant, the SPR imports in the incident library the events that are considered significant in terms of risk prevention and ALARA practice. The SPR completes the incident library by including reported OE aspects raised by SPR field operators.

For each selected event, the SPR engineer in charge of OE identifies:

- the main plant system to which the event is linked ;
- the operational documents (maximum of 2) to which the event is linked ;
- key words (maximum of 2) to which the event is linked and that can be used for the search to find an event.

When an activity is prepared, SPR members look through the incident library. Thanks to the operational documents or to the key words or even to the main plant system, they will rapidly access the events they are interested in and take into account the related OE.

The actual implementation and regular usage of the incident library has been confirmed at several occasions.

**7.1(b) Good practice:** The SPR engineering section has a very innovative method of including mandatory requirements together with field activities in documents developed by the SPR: ‘the implementation loop’.

The inclusion of the mandatory requirements related to radiation protection in the local procedures is one of the responsibilities of the SRP. The risk exists that engineers who write local documents are far from the field and write very specialized documents from an office standpoint but which cannot be applied in the field.

Each time a mandatory requirement is issued or modified, the respective SPR engineer has to implement it according to a three-steps approach:

- Planning phase: the SPR contacts the users (those who will have to apply the document) and involve them in writing the document in order to incorporate their opinions. It does not mean a negotiation of expectations, but an investigation on the way they can be applied.
- Implementation phase: the SPR explains the document to the work teams having to implement it. This can take the form of a specific training.
  - OE phase: after a period of time the SPR provides OE on actual application of the document. He incorporates OE by amending the document, thus returning to the planning phase.

The feedback loop forms an integral part of the projects at Penly to stimulate the presence in the field.

## 7.2. RADIATION WORK CONTROL

**7.2(1) Issue:** Although dose assessments and risk assessments are done, with various inputs from analyses and the experience feedback from Penly and other plants, the system is complex and does not give a synthetic view on the followed approaches, neither on the risks or preventive measures that must be taken.

On several work places both in the controlled area as outside the controlled area, the site sheets (*'panneau de chantier'*) that should summarize risks and preventive measures are present. These sheets could be useful information tools, but it seems that they are only partially completed. There is also no evidence that these sheets are reviewed by the SPR or by the site supervision and that they integrate the conclusions from the performed risk assessments.

For the interventions related to the fire sectorization that were ongoing during the OSART mission, a dose assessment was made, combined with the standard risk checklist. Another risk checklist according to another methodology was also completed. There is no evidence that some conclusions from both assessments were transmitted to the contractor on the field.

On the radiation dose assessments, the allocated radiation risk level (N1-N4) is sometimes marked, sometimes not. It is thus not evident that those who are executing the intention know which radiation constraints apply.

On an intervention plan of a contractor presented during the OSART review, the risks and associated measures were only identified by the references to the documentation file that should have included the assessment. This practice on its own does not allow a clear overview on the conclusion of the assessment.

For an intervention on a sump for the collection of non active polluted effluents, three different risk assessments were performed. One had a contradictory conclusion, two non-coherent conclusions. It was explained that the work was performed according to the conclusions of a fourth risk assessment made by the contractor.

Without a synthetic view on the risk assessments that were performed and on the identified preventive measures, some aspects could be forgotten and the information that should be given on the field on the preventive measures could be overseen.

**Suggestion:** The plant should consider to introduce a rigorous approach assuring that the synthesis of the performed risk assessments is clearly understood by the workers on the floor. The transmission of information could be achieved by paying more attention on the role of the 'site sheet'.

**Basis:** IAEA BSS – Safety Series 115 – Appendix I.26

### **Plant response/action:**

Following the suggestion made by the OSART team, the plant reviewed how to address the issue in a pragmatic way and decided to keep the existing practice, namely the “worksite

sign” and to improve it by adding RP requirements and a summary of information from the risk assessment performed by the work team leader. This consisted of:

- A reorganised layout to give it a more user-friendly format;
- Integration of a new field for any random checks that are carried out. These checks are those performed by the contractor supervisor or by craft supervisors during their field inspections. In its capacity of expert, the risk prevention department also checks and signs “worksite signs” on the occasion of field inspections that it conducts as part of its duties.
- Addition of a specific sign posted next to the general worksite sign for jobs potentially involving the spread of contamination. This sign is systematically approved by the risk prevention department for jobs involving significant contamination risks, i.e. surface contamination above 400 Bq/cm<sup>2</sup> or when the opening of an active circuit is greater than 100 mm in diameter.

These new arrangements are ready for implementation in the field. The plant has decided that the forthcoming outage in July 2006 was the ideal opportunity to implement this practice on a wide scale.

#### **IAEA Comments:**

The actions the plant has selected as response to the OSART suggestion aim to standardize and make more consistent both existing methods of risk assessment. The new approach continues to assign a high stake of responsibility to the worksite supervisor, who has to fill in the risk prevention sheet based on the already available risk analysis. This method ensures that the worksite supervisor carefully studies the work conditions and has to actively consider possible hazards and countermeasures. The new approach will also call for an independent (third party as compared to worksite supervisor and EDF counterpart) evaluation in majority of cases of outage works to ensure that risk management for the given work is appropriate.

However these changes to the process of individual industrial hazard prevention have not been implemented yet but are being prepared for application starting from July 2006.

**Conclusion: Satisfactory progress to date.**

**7.2(2) Issue :** Although the signalization related to the radiation hazards is meticulously done, there are still areas for improvement or simplification.

On some warning sheets within the controlled area the dose rate is given in  $\mu\text{Sv/h}$ , on other in  $\text{mSv/h}$ . This is a regular practice. Nevertheless experience shows that this can lead to confusion, e.g. the ambient dose rate of a room is labeled at  $20 \mu\text{Sv/h}$ , the dose on a container within this room at  $0,180 \text{mSv/h}$ .

There is an EDF policy to foresee only a warning at the room entrances and on hot spots (which have a relatively high dose rate, more than  $2 \text{mSv/h}$  and ten times the ambient dose rate). Mostly in bigger rooms the radiation dose rate can be locally significant, although not reaching the level to be formally categorized as hot spot. People entering the rooms are not warned from which areas they should really keep distance.

Actually there is a subdivision of the controlled area in A, B and C zones related to the contamination risk and the way the waste produced in these zones should be treated. There are also D-zones where the risk is totally negligible and where the waste can be treated as conventional. With the new EDF policy, the zone nomenclature will now change in N2, N1, NP and K. The methodology is not easy to understand. The nomenclature and the used symbols (circles arced with lines) are not straightforward. Confusion is further possible with the radiation levels defined as result of dose assessments. These first two levels are also called N1, N2.

There is not a systematic radioactive warning label applied on bags or containers that are used for the transfer of radioactive samples or wastes between the different controlled areas on the Penly site. Although the exposure risks are in most cases very limited, attention should be paid that no confusion is possible and that an item should not get inadvertently lost.

Without further improving and making efforts to simplify the warning system, there are still areas for confusion or low effectiveness, especially for those who are less familiar with daily work in a nuclear environment.

**Suggestion:** Consideration should be given to improving and simplifying the warning signs as part of the plant's ongoing programme of improving signs in the plant. Some examples are:

- identifying the dose rate uniformly either in  $\text{mSv/h}$ , or in  $\mu\text{Sv/h}$  ;
- identifying the areas with significant radiation fields by an appropriate warning, especially in the bigger rooms that are regularly occupied;
- applying simple and straightforward symbols regarding the contamination hazards;
- applying systematically a fixed warning sign on all packages used for transfer of radioactive items between the controlled areas.

**Basis:** IAEA Safety Series NS-R-2, para 8.1; IAEA BSS – Safety Series 115 – Appendix I.23

### **Plant response/action:**

Since the end of 2005, Penly has chosen to use the millisievert for dose values. All dose forecasts, radiological and radiological surveys are now carried out in millisieverts and the new RCA dosimeters are calibrated in millisievert/hour. Only a few exceptions remain, including certain measuring instruments such as FAG-type radiation meters.

The EDF RP reference base, which applies to all EDF nuclear power plants, requires that we specifically signpost all hot spots. In order to address the suggestion formulated by the OSART team and to improve our ALARA programme, we now signpost significant hot spots located in green zones. A significant hot spot is defined as a source emitting a dose rate of above 0.025 mSv/h (yellow zone) at a distance of 50 centimetres. This measure was incorporated into the risk prevention department's work procedure on "RCA radiological checks". In addition, the same RP reference standard points out that the length of time spent by any worker in an area with a dose rate exceeding that of a green zone must be kept to a strict minimum.

During outage periods, Penly NPP signposts ALARA areas at each level of the reactor building, these specific areas being reputed for their low dose rate and where workers are advised to stand when filling out or reading their work documents.

Signposting of contamination risks is compulsory and is uniformly applied on all NPPs, in accordance with DPN directive 104. It is therefore our duty to apply it. Since the end of 2005, the new signposting system for room contamination risks has been up and running. At the same time, workers have been briefed via the publication of articles in *Esprit d'Equipes* (no. 127, December 2005) and on the occasion of a specific briefing carried out by the engineering department and attended by line departments.

Since December 2005, all on-site transport containers (radioactive samples, equipment and waste) display a trefoil sign indicating their content's radioactive nature.

### **IAEA Comments:**

The plant has introduced several actions in order to improve signposting of radiation and contamination risks. Dose rate is now uniformly expressed in mSv/h units what eliminates the potential for any confusion. The application of PREVAIR system for dose forecast and CARTORAD system for radiation survey has also contributed to the use of uniform units for dose rate.

The tour of the radiation controlled area of unit 2 has confirmed that the signs related to dose rate now systematically apply mS/h units. Only two exceptions have been noted, in one case  $\mu\text{Sv/h}$  was applied, in another case the prefix of the unit was hand corrected, causing not easy legible sign.

Hot spots are signposted now also in green zones. A new signposting system for contamination risks has been introduced. This was confirmed during the tour of the radiation controlled area of unit 2.

**Conclusion: Issue resolved.**

**7.2(a) Good practice:** The Prevention and Radiation protection Service (SPR) has organized a campaign for systematic eradication of radiological hot spots in order to optimize lower doses.

As part of plant radiological monitoring, the SPR organizes the mandatory monthly radiation survey of dose rates inside buildings. During this activity and based on changes in ambient dose rate, the SPR identifies radiological hot spots on the plant. As a result, hot spots are trended and the effectiveness of corrective actions can be assessed.

Instead of simply shielding, which is the most current practice, preference is given to investigate measures to eradicate the hot spots. The SPR and operations service jointly analyse the hot spots, identify their possible origin and define eradication strategies. This can be the flushing of the systems, clearing of pipes, removing unnecessary pipe sections, installation of permanent shields with integration of seismic resistance and other safety-related concerns.

Recording, monitoring and the results of corrective actions are tracked according the plant quality assurance system.

### 7.3. RADIATION DOSE CONTROL

**7.3(a) Good practice:** A well-defined approach has been set up to control and follow potential internal exposures. The approach takes into consideration both scientific and human performance aspects. The team acknowledged that this good practice is done in French plants, but wanted to bring to the attention of other nuclear plants

Contamination can be detected at the various plant portal monitors. Once informed of the problem, the nurse comes to get the person and takes them in the on-call vehicle to the medical centre decontamination room after they have put on clean coveralls. Inside the decontamination room, a complete detailed body examination is carried out. An examination report is drawn up on paper and external decontamination is carried out in compliance with the procedures.

At the end of this decontamination, a whole body count is carried out on the person dressed in protective paper clothing. The whole body count has two levels of identification involving medical actions. The level (D) corresponds to an internal contamination, which could result in an effective integrated dose of 0.5 mSv (threshold for reporting at EDF). In this case treatment is dispensed and complementary examinations (radio toxicology of urine and faeces) are requested.

The contaminated person is informed that during the time of the complementary examinations he cannot go into the controlled area and he receives temporarily the authorization to bypass the C3 monitors at the exit to the site. If needed care is also taken for psychological aspects, in order to alleviate any traumatic effect of the event. In order to do so, the medical team can rely on a system implemented by several site doctors and whose aim is to reply to the main questions posed by people who have been contaminated internally. A copy of the examinations is given to the contaminated person as well as to their company doctor if they are contractors.

On the days following the event, the person is invited to undergo whole body counts in order to monitor the elimination of contamination from their digestive tract. Radio-toxicological examinations (urine and faeces) are sent to the relevant EDF lab and to the Authorities for inter-comparison. Finally, should a dose above 0.5 mSv be registered, a report is sent to the employee's company doctor if a contractor is involved. For EDF staff it is inserted by the site doctor into the DOSIREG computer application.



## 7.5. RADIOACTIVE WASTE, MANAGEMENT AND DISCHARGES

**7.5(1) Issue:** ISO 14001 is in place for the environmental management system, however, solid radioactive waste aspects are not emphasized enough by Penly NPP.

There is only one goal related to the production of radioactive waste: the volume of waste per unit produced outside the outage period. From 2005 it is planned to abandon this objective and to replace it by the produced quantity of metallic waste drums. But the metallic waste drums are only a part of the total waste production of the plant, which is also packaged in plastic drums, concrete shells and containers.

On the whole ISO 14001 action plan, there is actually only one action related to the production of solid waste.

There are no detailed analyses made in order to investigate the causes that can explain the increasing trend of the total solid waste production.

In the different (risk) assessments that are made in preparation of interventions in the controlled areas, the assessment of the foreseen waste production and the measures to limit the waste production are not really addressed.

Without emphasizing the radioactive waste in the environmental policy of the plant, the interest for the waste reduction programme will remain at a relatively low level. Resources could be lost to much less significant environmental aspects.

**Suggestion:** Consideration should be given to put more emphasis on solid radioactive aspects, in order to minimize the amount of waste generated. Additional ways of doing this are:

- Increase the significance of the solid radioactive waste production in the ISO 14001 environmental management system.
- Perform a detailed trend analysis of the different radioactive waste streams.
- Define a set of goals per service and define related actions in order to decrease the production of technological waste. Integrate systematically a 'waste assessment' in the risk assessment methodologies.

**Basis:** IAEA Safety Series NS-R-2, para 8.9.

### **Plant response/action:**

Performance indicators for the ISO 14001 environment management system pertaining to radioactive waste now incorporate the production and storage of concrete shells, the production and storage of all low-level waste drums (metal + polyethylene), deficiencies in waste sorting and dose equivalent rate, deficiencies in keeping track of waste bags, as well as the occupancy rate of the very low-level waste storage area. Since 2005, actions to reduce the amount of radioactive waste produced have been taken in line with corporate directive DI 104, and have been incorporated into the ISO 14001 management monitoring process.

Statutory waste reports have been drawn up annually since 2002. In view of our track record, trends in the various streams of radioactive waste are systematically reviewed when the report is published.

In addition to the systematic review of radioactive waste produced during each outage, a systematic waste reduction analysis is required prior to the start of any major jobs in the RCA during power operations (action incorporated into the plant's medium-term business plan for year 2006). In 2006, few significant jobs are affected by this analysis. Examples include activities being performed on boron recycling lines.

The radioactive waste reduction programme initiated as part of directive DI104 involves a number of plant departments. The following list describes some of the main actions underway or under review:

- ✓ Slippers used to enter or exit hot changing rooms to be treated as conventional waste,
- ✓ Downposting of liquid effluent tank storage areas prior to carrying out earthworks, in order for rubble to be disposed of as conventional waste,
- ✓ Downposting of elevators or goods lift machinery in controlled areas,
- ✓ Various types of waste produced in the controlled area to be disposed of as conventional waste, e.g. neon strip lights, batteries, motor lube oil fills, air supply filters.

Risk assessments used on the site now systematically include a waste production questionnaire in order to try reducing the volume of waste produced.

The "waste production" training course that was run from 1999 to 2002 has now been reinstated. Its aim is to raise lead worker awareness to the issue of radioactive waste production by looking at sorting, monitoring and economical aspects. About thirty plant employees are expected to attend the course in 2006.

#### **IAEA Comments:**

Since the OSART mission the plant has assigned more emphasis to the topic of radioactive waste production in the frame of the environmental management system. Several indicators have been selected to provide a more detailed characterization of the efforts to limit and reduce the production of radioactive waste. It has been correctly decided that breakdown of target values to the level of most "waste intensive" activities will support the achievement of the overall plant goals in this area.

It is due to several extra modification and reconstruction activities (which account nearly for half of the generated waste) that the ultimate goal of reducing the amount of solid radioactive waste could not be achieved in 2005. It is reasonable to anticipate that such a rigorous approach to individual works having the highest impact on waste generation and several elements of the waste reduction programme will bring their results in the long run.

#### **Conclusion: Issue resolved.**

**7.5(a) Good practice:** All nuclear waste present inside the waste treatment building (concrete drums and other waste) is managed on a near real time basis with a full inventory and package plan. With this tool, an action plan can be implemented. Each year, this action plan is reviewed in order to decrease the inventory of the waste building, hereby also dealing with the historical waste items stored there for a longer time.

The plant objectives related to the inventory of the waste treatment building involve both concrete and metal drums generated during the year but also the historical waste items stored for a longer time as extra treatment is needed or special arrangements have to be foreseen with control bodies. An inventory of all the waste present in the BTE and the very-low activity storage area has been drawn up. A package plan is updated at each movement of waste within the storage areas.

The reduction of the historical inventory decreases the dose rate and the risk for inadvertent contaminations on the surrounding area (ALARA principle).

An action plan is drawn up every year to achieve fixed targets. This action plan reviews each type of waste (concrete drums or other) and determines the actions to be taken to ship them by setting the priorities for the following year. The origin of packages that are not in compliance (concrete shells) is also determined and corrective actions are put in place before the package is produced.

Performance indicators are monitored every month and reported both to the site management and to the EDF national organization in charge of the treatment of waste (UTO-DC). These indicators make it possible to raise an alarm when the inventory in the storage areas becomes too high in comparison with the regulatory specifications (especially for the very low activity storage area).

## 8. CHEMISTRY

### 8.1. ORGANIZATION AND FUNCTIONS

At Penly NPP, the activities related to the field of chemistry and radiochemistry are under the responsibility of the Technical Department (ST), except the field of chemistry of the demineralised water preparation station. The laboratory team, which belongs to the ST department, is responsible for chemical analysis, radiochemical analysis and conditioning of primary, secondary and auxiliary systems during all plant operational modes. In addition, the laboratory team analyses and manages the liquid radioactive and non-radioactive effluents and the gaseous releases. Thus, chemistry activities are almost concentrated in the laboratory team, which makes the quality of chemistry activity very high.

Site's Joint Services Team (ECS), which organized in the Miscellaneous Operational Services Department(SMO) , is responsible for operating the demineralized water preparation station. In this entity, organized 4 years ago, function of chemistry, operating and maintenance are assimilated. This innovative and unique entity contributes to the smooth operation of the demineralized water preparation station and keeping the makeup water quality.

The management of the plant recognizes the important role of the departments related to chemistry and gives them the necessary support.

Descriptions for every functional position in the department related to chemistry are available. Responsibilities and authorities are clearly defined.

The management team (EDS), which is composed of the department manager, assistant managers, laboratory team leader, tests team leader and cadre engineer, in the ST department responsible for planning activities, for drawing up procedures and instructions. On working days, pre-job and post-job briefing of the laboratory team are carried out to confirm the schedule and results of the chemistry analysis. Every member receives minutes of this meeting. The plant policy is to provide also information in the daily team meetings. EDS is contributing to the realization of fluent flow of information according to the plant policy. Thus briefing helps information sharing among the whole team.

The Corporate Laboratories Department (CEIDRE) defines the operating and monitoring technical specifications for the circuits in the chemistry and radiochemistry area. The specifications and procedures are clearly identified and described. CEIDRE is responsible for developing analytical and chemical methods, supplying research capacity on special request, recommending analytical instruments, collecting and assessing data from all EDF NPPs and is strongly supporting the team activities.

Apart from outage periods, there are no shifts in the departments related to chemistry, but enough number of on-call chemists are available at all times, ready to help the plant operation when a chemistry anomaly appears.

The ST department has established a very comprehensive system of chemistry performance indicators. The main chemistry performance indicators connected to chemistry and radioactive effluents are used with appropriate trend analysis, and information about the indicators is properly disseminated in the plant. Expected and limiting values of indicators are also expressed.

Contractors are used for maintenance of some measuring equipment and their tasks are clearly defined.

On working days, morning chemistry review and evening chemistry debriefing are carried out to confirm the chemistry aspects of each unit in the main control room, with operations shift supervisor, operators and the chemistry coordinator, using liaison folder.

The liaison folder is well-devised and systematic communication tool between the Operations department and Chemistry department (see good practice 8.1).

Not only the ST department but also other departments, especially Operations realize the contribution of good chemistry to minimize corrosion, activity build up and liquid waste decrease. These departments understand the importance of monitoring the main chemical parameters as required by the ST department.

The trends of most of the main parameters are analyzed. The chemistry specifications are well defined and structured and the expected values and limited values for every parameter are determined. If the expected value is exceeded, a possible anomaly should be identified, and eliminated as soon as possible in order to get back to normal operating condition. Also, the evaluation of the cause of the small variation of the main chemical parameters is carried out. Thus, there is effective response system to chemistry parameter variations.

Training consists of 12 skill-based categories. The plant has training programmes such as shadow training, standard training plan for specific job (PTF), and team training etc, programmes. For each training responsibility is clearly defined. Team leader and shadow trainer are responsible for shadow training, training department is responsible for PTF and team leader is responsible for team training. Each category has four levels.

Shadow training programme consists of theory, knowledge, practice and application, and its procedure was developed in Penly. It describes the detailed contents, which the trainer should instruct to the trainee. PTF training is conducted according to corporate level training manual.

Team training is led by team leader. Training in another department with clear objective is also conducted. The content of training is updated with the operational experience feedback. Thus, training programme is well established and implemented.

All training records are registered in individual training log (CIF) and this log is regularly updated. Evaluation is conducted based on procedure of assessment (ADP).

Each year, team leader interviews all personnel to evaluate their competencies. Rotation among their six work stations is conducted every three months to maintain skills of each person.

The number of competent personnel is checked by each category. The Chemistry Manager has also estimated the future number of competent personnel of each category and planned necessary measures. Thus, training programme is well managed and reviewed.

Procedures of chemical analysis and some other necessities are well provided in all laboratories, and checks are carried out periodically. In addition, at the entrance of the laboratory in the demineralization station, a number of emergency procedures are made

available to the ECS. Each of these sheets is easily accessible and placed in an individual plastic folder, and the topics of each sheet are easy to find.

## 8.2. CHEMISTRY CONTROL IN PLANT SYSTEMS

Chemistry control of the plant and monitoring programme for the primary and secondary systems were established by CEIDRE based on materials used in the plant. The ST department is using a corporate Laboratory Information and Management System (LIMS) called Merlin. This LIMS contains national and local specification, analysis frequencies and quality control data of instrument. It is also used to store and compare data, to process and to visualize them.

About one month before starting the plant outage, shut-down procedures and indicators are clearly defined on the basis of consultation with operation department, and the plan is carried out securely and the variations of main parameters are well-analyzed.

The makeup water system is operated to provide sufficient volume of demineralized water. The quality of demineralised water produced at the demineralization water station is properly monitored by on-line measurements of pH, conductivity, sodium and silica. During summer season, disinfectant is injected the raw water storage tank, in order to keep high quality raw water.

The chemistry department refined the effluent treatment procedure to decrease liquid radioactivity discharge. Before starting treatment, the ST department measures concentration of radioactivity and chemical parameters in order to select the optimum treatment system. In addition chemical parameters are measured at the tank in the process. With this method good results are obtained.

In order to ensure regulatory limits and decrease the discharge of liquid effluents, the ST department requires the expected discharge rate of the effluents to be much lower than the limiting value.

The primary circuit is operated according the coordinated lithium/boron chemistry concept to minimize corrosion and to reduce the transport of corrosion products. Though the lithium/boron ratio occasionally exceeded the expected value, the number of such cases is decreasing and continuous effort to further decrease them is carried out. In addition, through the comparison of the lithium/boron ratio with the Golfech NPP, the analysis for decreasing radiation rate of the equipment is carried out.

In the secondary system, the all-volatile treatment (AVT) is used which is established by injection of hydrazine upstream of the condensers. Various kinds of chemical parameters, important for keeping the integrity of secondary circuit, are controlled well. For example, the feed water pH is kept in a narrow band ( from 9.4 to 9.6), dissolved oxygen concentration is kept around 1ppb.

Trend analysis is carried out for the important chemical parameters systematically, and the evaluations of the cause of variation of main chemical parameters are carried out not only the case of deviation from the expected value but also in the case of small variation.

### 8.3. CHEMICAL SURVEILLANCE PROGRAMME

The chemistry surveillance procedures have a clear structure and contain all necessary information to perform reliable work.

The integrity of fuel cladding is monitored based on radio chemical specification and the SPE026 during normal operation, power transient and shut down period. The monitoring parameters, frequency and criteria are well defined. The trends of these parameters are traced and evaluated using Merlin, which is also used to make a schedule the monitoring. These data are also available on EDF Corporate level and support is provided to the plant if necessary. If fuel defect is suspected by monitoring, sipping test in the unloading mast and/or in the spent fuel pool is properly prepared and conducted to identify defective fuel assemblies.

The sampling plans and procedures are clearly defined and conducted including flashing time of each sample line.

Calibration of instrumentation is carried out in sufficient frequency and using proper equipment. Calibration schedules are well controlled and monitored. In addition the calibration permissible ranges are optimized, and they depend on trend analysis.

For example, the boric acid concentration is monitored by automatic measurement equipment and chemical analysis is carried out once a week, and the results are conveyed to the Operation Department. Staff of the ST department compare values, and if the difference between the two values exceeds 5%, then the calibration of boron meter is set up.

The ST department participates each year on round robin test to verify methods and instrumentation and to improve competencies of the laboratory team. The frequency of the inter-comparison of the chemical analysis results is sufficient to achieve their objective.

In the ST department, the systematic risk analysis system is established. They collect the minor mistakes even if those are not deviation and discuss about the risk and carry out the preventive action in case of necessity. (See good practice 8.3)

The results of chemical and radiochemical analysis and the measuring equipment condition are checked and the information is transmitted to the all members of laboratory team in the daily meeting.

### 8.4. CHEMISTRY OPERATIONAL HISTORY

In the ST department, responsibilities for reporting and assessment are clearly defined. Technicians and CPAs are responsible for analysis and reporting of the unconformity in their experience. EDS members are responsible for analysis and reporting of department level event concerned with chemistry. Especially the activities during the plant outage are sufficiently analyzed and reported. Trends of main parameters of primary circuit, secondary circuit and liquid effluent discharge are analyzed and reported to the plant managers in every two months.

All data are stored in Merlin and they are easily accessible to all staff.

In the ST department, systematic and effective laboratory experience feedback system is established.



## 8.5. LABORATORIES, EQUIPMENT AND INSTRUMENTS

The plant has ten laboratories and they are set up appropriately for different analysis task. All laboratories have enough space and are in good housekeeping conditions. Though some laboratory instruments are old, all instruments have a specific maintenance programme in accordance with EDF Directive 61 and are kept in good condition and are operated by skilled staff. All on-line analyzers are labeled with the dates of the last and next calibration. The documentation including calibration data is kept close to each instrument.

Laboratory chemicals are stored separately depending on their properties. Hazardous reagents and radioisotope sources in the laboratories are stored in a box with a key kept separately. A list including all laboratory reagents is updated once in a year. At BAN laboratories lead shields for preventing unexpected radiation exposure are used as custom. There are adequate emergency showers and eye washers in the plant. Equipment and their maintenance meet international standards.

Samples to be measured in the hot laboratory are inserted in closed plastic bags for transportation in appropriate black cases. All samples are appropriately labeled with sampling date. Chemicals are appropriately labeled with the expiration date and recorded in the simple quality control information system.

The ST department has established systematic risk analysis process. Depending on the process, more than 50 numbers of preventive actions are carried out and all laboratory teams are informed quickly about them. Although some differences of performance between laboratories were observed, which may cause of confuse of technicians. These deviations were modified during the OSART mission.

The plant has installed a sufficient post accident sampling system. The measurement of gas phase will be performed by KRT chains (total beta radioactivity and dose rate) and additional analysis will be performed at corporate level. The liquid phase can be sampled depending on the type of accident from the shielded cabinet at the hot laboratory or from the special shielded cabinet connected downstream of the low-pressure injection system pump. The total gamma radioactivity and gamma spectrometry measurement can be performed with the appropriately diluted sample.

## 8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

All EDF and contractor on-site activities are governed by the “Material and Equipment for use in power plant” programme (PMUC). The plant has the list of all chemicals and substances used in the facilities.

The conformity of most of the PMUC chemicals and substances are checked upon delivery at the plant, after being purchased by the CSM (Commande Stock Magasin). The in-plant temporarily storage and use of all the chemicals and substances are under the responsibility of each department manager.

The plant-level procedures include rules specifying that all chemicals and substances used in the plant have to be labeled or identified even if they are subdivided. However, the team observed that some of the chemicals and substances had a poor labeling designed to prevent any inappropriate use. The team is providing a suggestion on the labeling of chemicals and substances used in the plant. (See issue 8.6).

## **PENLY FOLLOW-UP SELF ASSESSMENT**

The period after the OSART mission was one of consolidation for us, while instigating some improvements so as to maintain the momentum of continual progress.

We questioned our laboratory practices so as to make progress in the main areas, namely operational safety, industrial safety, training and presence in the field.

Progress has also been made in terms of organisational matters, through implementing effective planning of laboratory work files that incorporate risk assessment, operating experience and identification of low-level events.

This new initiative for the laboratory also improves communication with what's happening in the field, incorporating a simple and effective suggestion system via permanent progress sheets included inside work activity files.

In addition, we have continued to implement our skills competency project e.g. writing up detailed job description requirements for chemists, progressive authorisation via shadow training, skills assessment in the workplace.

The completion of these actions coincides with an involvement from the chemists to improve performance.

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

In the area of Chemistry the team found that the plant has reached satisfactory progress in the response to the suggestion related to the quality control of operational chemicals and other substances.

The actions of the plant have been focused on labeling of chemical products stored not in their original container in order to ensure that information about the content of the container and associated hazards is available to anyone who might use the product or get in touch with it.

The plant tours to laboratories and stores provided both positive and negative results about the practical implementation of the new initiatives. This supports that the surveillance of labeling of chemicals as part of management controls when performing field tours is indeed required to ensure uniform application of the new requirements.

## DETAILED CHEMISTRY FINDINGS

### 8.1. ORGANIZATION AND FUNCTIONS

**8.1(a) Good practice:** The chemistry and operation liaison folder is established as a communication tool between the ST department and OP department.

The folder is kept in the main control room and includes the following:

- Chemical and radiochemical parameters (data related to technical specifications, including the equivalent iodine 131)
- list of the activities carried out during the day
- the corrective actions to be performed
- the parameters to be monitored
- the key activities to be carried out on the next day
- miscellaneous comments or observations

The information exchanged during the morning and the evening briefings, between the chemistry department coordinator (CPA) and the shift supervisor from operations, is tracked on a daily basis in this folder. The contents of the liaison folder is continuously improved.

This folder guarantees:

- suitable tracking of information
- technical specification related data immediately available out of working hours
- the 'equivalent iodine 131' data is available if required in the event of an emergency (EPP)
- a monitoring document displaying the main chemistry and radiochemistry trends

As a result, the liaison folder has contributed to facilitate and ensure the relationships between chemistry and operation departments and to optimize the coordination of the units.

### 8.3. CHEMICAL SURVEILLANCE PROGRAMME

**8.3(a) Good practice:** Considering laboratory-related risks: risk analysis  
A very effective and systematic risk analysis process is established in the chemistry section.

A risk analysis is formalized in all laboratory procedures using a pre-established pattern (risk identification per field and associated defensive measures). For specific activities (such as sipping tests on the fuel assemblies, sampling from safety injection accumulators, calibration of the oxygen-meter on the gaseous effluent treatment system, among others) that have been listed in a daily activities management form in the Technical department (ST), a quality plan is drafted with the incorporation of the risk analysis.

These risk analyses take into account the external experience feedback as well as internal experience feedback provided by the post-job briefings. The risks detected are

incorporated and reminded during the pre-job briefing associated to the corresponding action.

In addition, the department has set up the use of Files on Safety or Industrial Safety Related Risks (FIRS). These FIRS enable low level events to be reported by plant personnel and are added to the pre-job folders for internal Experience Feedback purposes. This analysis is undertaken by plant personnel who make the findings. The team then collectively analyses the experience feedback and proposes corrective actions. These are analysed and validated by the department management team (EDS). The decision is then communicated to the team and taken into account for pre-job Experience Feedback.

As a result, issues are collected and analysed very widely and rapidly, and reports are disseminated to all staff in a timely manner.

Laboratory Experience Feedback process is incorporated into the daily management loop for an activity.

The reported experience feedback is discussed weekly during a lab team meeting and is added to the pre-job preparation folder where the experience feedback is classified into different areas. After carrying out the activities based on the analysis, discussion takes place again. This cycle rotates continuously.

As a result, a number of reports (external and internal) are drafted and analysed by the team, and are added to the experience feedback folders (approximately 70 reports/year).

## 8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

**8.6(1) Issue:** Although there is a labeling rule for the identification of chemicals and substances, the labeling during temporary storage and use of chemicals and substances is not sufficient to prevent inappropriate use or disposal:

- when visiting the laboratory, it was noticed that liquid soap in plastic containers is stored in the locker of the laboratory without any identification.
- when visiting the turbine hall, it was noticed that one of the yellow boxes containing absorbent powder did not have a identification label on it.
- when visiting the BAN building, the label of a stored container with solvent in it was poor. Besides, in the room, there was a smell coming from the container.

Poor labelling or identification of chemicals and substances may lead to a higher risk related to their inappropriate use or to them having a noxious impact on the plant systems, equipments and health.

**Suggestion:** Consideration should be given to the enhancement of the labeling procedure related to the temporary storage and use of chemicals and substances. This would prevent any inappropriate use and disposal of these products. The setting up of a surveillance programme on chemicals and substances labeling may be effective to avoid any inappropriate labeling.

**Basis:** IAEA TECDOC 489 sec. 1.4

### **Plant response/action:**

From an operational safety point of view, risks associated with using an unsuitable product on plant facilities affecting safety are addressed by using **products carrying the 'PMUC' label** (PMUC meaning products approved for use nuclear power plants). The main warehouse and the unit warehouses only issue products in their original container. Only the oil stores is authorised to issue oil in a different container. When partial separation is performed, the storeman attaches a specific PMUC label.

From the industrial safety, fire risk and environment point of view, any product not in its original container must be identified and have the same hazard symbols as the original container from the supplier.

Concerning conventional waste, since July 2004 any product not containing a hazard warning label is refused by the contractor in charge of the waste transit storage area.

Since 1st March 2006, **self-adhesive labels** (see picture) have been made available at the oil stores and the unit warehouses within the RCA. Use of these labels has now become mandatory for any temporary storage, handing or use of a product in a specific container.

All persons performing handling have been given instructions to refuse to move a container whose contents are not clearly identified.

These requirements are being implemented on a temporary basis via a decision sheet from the Miscellaneous Operational Services Department, while waiting for their integration into plant standards. Indeed, the risk prevention department is working on an overhaul of current memoranda, finalisation being planned for the end of the first half of 2006.

Without waiting for this update, presence and quality of labels form part of management controls when performing field tours.

### **IAEA Comments:**

The actions of the plant have been focused on labeling of chemical products stored not in their original container. The new requirements addressing the issue have been introduced into laboratory procedures or communicated via decision sheets, but the overall plant memo on the use of hazardous substances is currently under revision with June 2006 as deadline.

During the tour to the hot chemistry laboratory NB 0426 no deviations from the requirements of labeling chemicals were observed. Visit of the oil store, the hot chemistry laboratory in SUC building and local store room NB 0734 confirmed that the new requirements are applied in the field, with the exception of some deviations noted:

- A plastic container with approximately 3 liters of liquid was marked by handwritten note as “detergent” was found on a shelf in the oil store. The container had no PMUC label or risk identification label attached.
- A plastic container with approximately 4 liters of absorbent was found in the hot chemical laboratory marked by handwritten note as “Super Absorbent PMUC”, but no PMUC label was attached. It was explained that this absorbent at present is not allowed for use and should not be in the laboratory.
- A container with 1 kg Bismut (III) –nitrat with a label indicating that it was opened on 25/10/2005 and expiry date is 25/10/2010 had another old sticker attached, indicating that date of receipt to the store was 2000 and validity date is 2005. It was explained that the second label should have been removed because it might cause confusion.
- Several plastic spray bottles and a plastic container without proper labeling were found in the local store room NB 0734. It was explained that they contain
  - window cleaner,
  - grease remover,
  - a liquid to be applied to fix contamination on clothes in order to avoid potential spread of contamination.

These exceptions support that the surveillance of labeling of chemicals as part of management controls when performing field tours is indeed required to ensure uniform application of the new requirements.

**Conclusion: Satisfactory progress to date.**

## 9. EMERGENCY PLANNING AND PREPAREDNESS

### 9.1. EMERGENCY ORGANIZATION AND FUNCTIONS

The responsibilities for emergency planning and preparedness are delineated and assigned among all bodies involved. EDF Corporate mainly states the structure of the complete alarm organization on the national and local level. EDF Corporate also prescribes in detail how the emergency plan should be implemented on the local level. EDF Corporate agreed on this structure with the national authorities and the regulator and all EDF plants have to implement the prescribed internal emergency organization (called PUI) and to make the prescribed arrangements with their Prefecture. EDF Corporate itself is responsible for the national part of the organization.

The different internal and external plans for local, regional and national level responses are consistent with each other. EDF Corporate sees to it that every site implement its own local PUI and that it makes the necessary conventions with the local Prefecture according to the prescribed structure.

Without being witness of an integral exercise of the complete emergency structure the team has the feeling that this organization as a whole can co-operate effectively in responding to an emergency situation.

The internal emergency plan has clearly defined responsibilities and authorities. There is unity of command with the Local Management Emergency Centres (PCD) manager being the highest command and all other command centres reporting to him. The PCD manager makes the decisions and he advises the Prefect on counter measures to be taken in the environment. EDF Corporate in Paris will only advise the PCD and cannot overrule him on operational matters concerning the response to an emergency. The responsibilities and authorities are clearly stated in the documents and expressed by the managers from different control centres. The Prefect is the highest public authority in case of an emergency. As in the internal organization there is also unity of command within the public authorities, with the Prefect making the operational decisions and other parties advising him. All parties state that the PCD is primarily responsible for the response on the site and that the Prefect is responsible for the response and counter measures in the surrounding area. There is one exception: in case of an early release the site may trigger the external alarms to alert the people in the direct vicinity of the site ( $\leq 2$  km).

There are a total of 265 qualified people on site that can be scheduled for fulfilling emergency response duties. The total number of people on-duty for the internal emergency plan at any time is 53. This means that there is an average of 5 persons for each position in the internal emergency organization. This is sufficient to staff the organization during the year and ensures enough backup for shift turnovers in case of a long lasting emergency situation.

The internal emergency plan and all action sheets and procedures are in a comprehensive QA programme. The internal emergency plan documents are all coded ODC. Documents that are relevant for the internal emergency plan but not crucial for the emergency preparedness (for instance the list of assignable persons) are not in the QA system. This is allowable because the last mentioned documents only have an administrative function and no safety function.

The on-site emergency plan is implemented according to the prescriptions of EDF Corporate and matches with local and national external emergency plans. The off-site emergency plan



used by the Prefect is called PPI. The PPI is well supported by the operating organisation. The criteria to classify an event in one of the three classes used in the PPI, match with the information it is given by the site. The external fire brigade uses the same terms in their plans as the site; that means that the communication with the fire brigade can be accurate and swift. The Penly site has good relationships with the Prefecture and the external fire brigade. This is noticeable through their good cooperation concerning the preparation of documents, the conducting of combined exercises, training of personnel and familiarization of persons from both organizations with the radioactive aspects and buildings on the site. The team considers the good relationship and cooperation Penly NPP has developed with the regional department of fire and safety (SDIS) as a good performance.

The experiences from emergency drills and exercises are converted into actions when a deficiency in the emergency plan has to be solved. These actions are put into a database and prioritized with a date. The EPP engineer checks regularly whether the completed actions meet the intended objectives or not. Quarterly the EPP engineer discusses the outstanding actions with the EPP managers responsible for fixing the problems in the part of the emergency organization they are responsible for. Minutes of these meetings are prepared. The QA department has to agree when an action is going to be postponed, so there is a double check on the timely execution of actions. An average of 20% of the actions are not completed before the original due date. Conclusion is that there is attention to get a timely feedback and implementation of the experience from training drills and exercises.

The Local Management Emergency Centre called PCD is well maintained and directly operable with all procedures and communication means in good shape. The telephones and faxes are tested periodically. However, the team noted that not all tests are conducted within the prescribed time (about 20% are overdue). These periodic tests are triggered and recorded by the SYGMA database. In the SYGMA database the telecommunication tests are labelled as “non safety significant” and therefore the telecommunications department argues that these may be a “little overdue”. This might become an area of concern when the applied practices deviate further from the prescribed standards.

The Site Assessment Emergency Centre (PCC) and the Local Logistics Emergency Centre (PCM) are also well maintained and directly operable. The team noted that there was no protective clothing stored in this building. The responsible manager agreed and corrected this shortcoming. Equipment and resources stored by the logistics part of the PCM look good and are all included in inventory lists. The command centres have sufficient water and food supplies stored within the same building. There was however no inventory list; one is being made.

## 9.2. EMERGENCY PLANS

The internal emergency plan is properly structured and implemented due to the clear and comprehensive corporate prescription used to build and maintain the internal emergency organization and a dedicated project organization. The EPP engineer is responsible for the overall structure of the local emergency organization and there are 7 managers each responsible for the implementation and correct functioning of their part of the internal emergency organization. Each of these managers, his or her department manager and the plant manager have signed an assignment letter that states the responsibilities of the manager in regards to his part of the emergency organization. It also states that the manager should at least work a specified number of hours per year on the emergency plan. The team considers this project organization to be a good practice, see GP 9.2 (1). The team also considers the

way the new local internal emergency plan is implemented and maintained on the site a good performance.

The local internal emergency plan (PUI) and the local external emergency plan (PPI) are consistent in a way that the same language is used and that the interfaces between them are well developed. The PUI and the PPI contain the criteria that are necessary to declare an emergency, to warn the Prefect (regional authority) and to classify the emergency.

In case of an event beyond normal operations the Duty Manager will be alerted on clear criteria in the operational procedures. The Duty Manager (PCD1) has a clear procedure to assess the situation, classify the event, activate the internal emergency organization and notify the external response organizations. He can do this from his home and still be on the plant within an hour after the first telephone call. The Duty Manager and all other staff on duty carry an internal pager that will be activated in case off an emergency during the day. Outside normal working hours the staff on duty will be alarmed via two different, independent communication means. This is via their external pager and in parallel with a spoken message on their private telephone. Both means are tested weekly on different evenings and declination of the mandatory acknowledgement of the alarms is documented and fed back. This redundancy makes the process more reliable. The team considers this being a good practice; see GP 9.2 (2).

The Site Assessment Emergency Centre called PCC adequately considers the source term and its consequences. The PCC has clear documents to define the applicable source term, with pre-calculated values of the expected releases, the consequences for the environment and counter measures to be taken. The applied intervention levels comply with IAEA guidelines. There is also a computer application what can take the current weather into account to give a more precise prediction and a plot of the contaminated areas. The source term documents called KGE also have predicted radiation measures the measuring truck personnel will read on their instruments in order to check the source term prediction with the actual outcome. The team considers the colour coding used in the assessment sheets and the guideline as a good practice to avoid mistakes in stressful situations; see GP 9.2 (3). The responsibilities for correction, mitigating and protective actions both on- and off-site are well declared. Off-site protective action recommendations are timely given to the Prefect, who has the authority to decide whether they should be executed. In case of an early release the prefect allows the site to alarm the people in the 2 km zone around the site by triggering the external alarms. This means that early sheltering of local citizens can even be done before the Prefecture is ready for action.

There are written agreements with the external fire brigade, local hospitals and a bus company to guaranty their cooperation on EPP matters and to state the mutual responsibilities. This means that there are solid agreements with external organizations.

There is special technical equipment dedicated to emergency actions, it is stored in two different places on the site. This equipment is listed and checked regularly. There is also special common equipment available for all EDF plants that is not stored at the Penly site: for instance hydrogen recombiners. If the PCM has to order a portal hydrogen recombiner, it takes one week to get it to the site. Although the recombiner would not be needed in the first day of an event, this could be quite long. In 2006 en 2007 passive hydrogen recombiners will be installed on both units what will make the portable recombiners superfluous.

The internal emergency plan has clear criteria to notify the Prefect in order to launch the external emergency plan. In the external emergency plan (PPI) there are well defined criteria to trigger the PPI and to classify the event. The PPI has 3 different categories to classify an event. The actions taken will depend on the actual phase of the emergency. The Prefecture has no expertise in terms of radiological hazards and will therefore in the first stage of the emergency fully rely on the advice given by the site. The sites intervention levels comply with IAEA requirements and are well defined.

The alarms to alert the public seem to be adequate. The public living around the power plant has had advance information on what to do in case of an emergency and they keep stable iodine pills in their homes. The tourists in the 2 km zone around the power plant should be informed by their hotel or camping. It is the responsibility of the mayors of the concerned villages that all tourists get this information. No one was sure however that this happens and that some kind of auditing of the local facilities on this matter exists.

### 9.3. EMERGENCY PROCEDURES

EDF Corporate defines the structure for the national and local emergency plan. They also provide a draft for the local on-site emergency procedures. Both structure and draft are obligatory for all EDFs NPPs and the national regulatory body has agreed on them. When a plant wants to make changes in the prescribed part of the procedures, it has to write a memo explaining the need of the change in order to get permission from the regulator. Penly has written a memo to get some changes in the obligatory part granted; permission was given by the regulator to do so. For the rest of the Penly PUI it is developed according to the general specifications of EDF. The procedures look well maintained. Every document has the name and signature of the author and a controller and is authorized by the plant manager. All emergency documents are reviewed annually. When at that moment there are no changes to be made, the document stays unrevised. To document that a review has actually taken place when a document stays unchanged, a so called "Avis de Reexamen" is written and signed by the author and the checker. When there is a major document change to be done the concerning document will be changed between official review dates. Non essential changes are gathered and included in the annual document review. The feedback from exercises and drills are gathered and used to update the documents. When exercises lead to comments on the documents, the documents are either changed (when the text is not mandatory) or the EPP engineer advises EDF Corporate to change the national draft documents. There is only one procedure for the internal emergency plan that has not been validated yet. This document is not required by the regulator or EDF but the plant wants to add it to the instructions for the PCM. The team concluded that the documents are properly developed, maintained and revised.

Activation of all emergency response organizations is well prescribed in the documents. In case of a radioactive release Penly will assess on clear criteria whether protective measures for the public have to be taken and will timely advise them to the Prefect. The documents clearly prescribe how this assessment has to be performed.

The PUI procedures include methods for determining the source term and estimating the projected doses both on the actual plant status as well as on a barrier prognosis. The radiation exposures and limits are accurately prescribed and comply with IAEA requirements.

#### 9.4. EMERGENCY RESPONSE FACILITIES

The emergency response centres on the site, at the Prefecture and at EDF Corporate are adequate. The EDF centres have redundant communication means and back-up power supplies.

There are two sorts of personnel gathering points: EPP gathering points for the gathering of personnel in case of an emergency in one of the units, and fire gathering points for the gathering of personnel in case of a fire in one of the administrative buildings. These two locations have different signs and are well identified by the applicable international symbols at the gathering points itself. The team considers that the signs pointing to the gathering points could be confusing because they are not consistent with the signs at the gathering points, see suggestion 9.4(3).

There are sufficient arrangements to evacuate the site, which is not done by the cable car but by busses. The plant has a contract with a transportation company in order to assure a timely evacuation. Tests are being conducted to see whether the evacuation will be timely. The complete staff can be evacuated to a gymnasium more than ten kilometres away, where they can be measured and decontaminated if required. The EPP gathering points (there is 6 equally equipped points) have everything needed and are well maintained. There is an inventory list in it and the inventory is periodically checked. The team considers the time needed to activate the gathering points and to determine the missing people being too long, see suggestion 9.4(1) and recommendation 9.4(2).

The incoming emergency supports meeting points are well identified, adequately located and sufficiently equipped. The medical centre on the site is adequately equipped to treat injured and contaminated persons.

#### 9.5. EMERGENCY EQUIPMENT AND RESOURCES

Penly has two vehicles for radioactive monitoring and sampling in the area up to 10 km from the site. The external fire brigade and the Institute for Radiation Protection and Nuclear Safety (IRSN) also have vehicles that can perform the same measurements at the same locations. Because all three organizations use exactly the same measurement points, they are complementary to each other. The two cars used for measuring contamination on the site and in the direct area around the site look very complete and ready to be deployed. All equipment in the cars is tested on a regularly basis. The tests are well documented and they also keep track of all repairs that have been done on the measuring equipment in the cars. All inventories in the cars are listed and regularly checked. There are 7 online sampling points (4 on the boundary of the site and three on 10 km distance) they are checked periodically and kept operable. Penly has a mobile local communication post called PCOM, which is also well maintained and ready to be deployed.

The assessment of the plant status is done by the readings in the control rooms, which have been designed to give accurate information on the plant status. The process computer is only used as a back-up because the availability of any process computer is less than that of the control room instrumentation. The accident assessment equipment is adequate and tested constantly because it is used during normal operations.

## 9.6. TRAINING, DRILLS AND EXERCISES

For every position in the emergency organization, there is a prescription of the initial training to become qualified for the job and a prescription of the periodic training, drills and exercises that are needed to stay qualified. Records of the attended training and exercises are kept for every person who is qualified for a task in the emergency organization. The department managers are responsible to check whether their employees stay qualified for their emergency tasks.

Drills and exercises are conducted to test and rehearse the tasks of the emergency organization as realistic as possible. The reports of conducted integral exercises look very complete. They mention the objectives, the scenario, the names of the observers and the points the observers have to look at and they also clearly assess the exercise results and actions to be taken. The scenarios of the integral exercises are well prepared. From 2005 the simulator will be used in emergency plan exercises what will make the scenarios even more realistic. A fire drill that was witnessed by the team looked well prepared, co-ordinated and conducted and there was a good debriefing of all persons involved. The team concluded that the exercises are well prepared, co-ordinated and conducted. The team considers the fact that Penly conducts more exercises yearly than the EDF Corporate and the regulator obliges them to do as a good performance.

## 9.7. LIAISON WITH PUBLIC AND MEDIA

The emergency organization is trained and prepared to communicate with the local and national media in case of an emergency. There are sufficient, qualified and trained personnel assigned for public information activities. The plant site works with contractors to conduct over 300 conferences in schools per year. The public information centres both on site and at EDF Corporate are well equipped and maintained.

Communication personnel are well prepared and have a general set of information sheets on all important aspects of nuclear operations with the potential consequences for the environment and the public. They use these sheets to explain radiological and technical matters in an understandable way to journalists and the public. The people in the vicinity of the power plant have been given information on what to do when the alarms sound. The public in the vicinity of the plant also receive a monthly leaflet called "Les Nouvelles" that gives information on potential emergencies, actual events and releases etc. This means that the site informs the public in the vicinity regularly about potential emergencies and actual events.

## **PENLY FOLLOW-UP SELF ASSESSMENT**

The OSART mission was of particular benefit to the EPP area as regards the insight provided by the reviewer into the aspect of personnel safety.

We revamped our signage over the period spanning 2003-2006 and made improvements to signs indicating the route towards muster points.

The OSART mission also showed us that we could indeed improve upon the way we keep count of people on the site.

Corporate policy, which we comply with, could also be improved. Proposals have been submitted to corporate level for review, prior to being potentially rolled out, benefitting the whole of the EDF nuclear fleet.

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

In the area of Emergency Planning and Preparedness the plant has achieved significant progress in response to the recommendation and suggestions made by the OSART team.

Regarding the recommendation about timely accounting of staff and the suggestion about timely activation of assembly points in case of emergency the plant initiated a revision of the existing practice by contacting the EDF corporate organization.

EDF corporate organizations provided several responses to this inquiry since April 2005 to March 2006. Reviewing these responses it can be concluded that the goal set by EDF corporate organizations is to be able to account for people in 30 minutes after the notification of an emergency. Several options to reach this goal will be analyzed to determine their efficiency and cost impact. The solution selected after this analysis will be applied at all EDF plants, and will also solve the issue of timely activation of assembly points. The deadline to report the results of the feasibility study is November 2006.

At first sight this schedule of actions may appear not to be very ambitious, however considering the size of the EDF fleet, the desire to apply standardized process for accounting of people across all plant sites during emergencies and the cost impact of implementing the new methods for accounting it still can be judged as acceptable.

In response to the suggestion related to marking routes towards assembly points in the radiation controlled area the plant has modified the existing symbols and added new signs. The tour to the radiation controlled area of unit 2 has confirmed that the old signs have been systematically replaced in order to apply internationally accepted pictograms.



## DETAILED EMERGENCY PLANNING AND PREPAREDNESS FINDINGS

### 9.2. EMERGENCY PLANS

**9.2(a) Good practice:** Assignment letter for the heads of the command posts. Preparation for emergencies is done by a project organization. Commitment of all persons responsible for maintaining a part of the project is assured by their assignment letter.

The preparation of crisis management on the site is organized as a project. In this project organization there are seven persons from various departments responsible for implementing and maintaining a defined part of the internal emergency plan. This means that each of these so called “heads of command posts” is responsible for his separate part and that all parts together form the complete emergency plan. In order to coordinate this task with their normal tasks, a management tool was introduced to make cross-functional tasks easier.

The operational coordinator for the “preparation of crisis management” project is the EPP engineer (Engineering Department). He relies on the heads of the command posts to implement the various parts of the project. In order to formalize expectations, namely in terms of responsibility and workload, an assignment letter has been drawn up for each head of the command posts. This letter is signed by the head of the command post (operator in charge of the assignment), by the head of his department and by the plant manager.

This letter allows for:

- Formalization of the assignments of the heads of command posts,
- A precise definition of the content of this assignment with regards to:
  - Material and documentation,
  - Human resources,
  - Organization and Management,
- Setting the time allocated to the head of command post to carry out his assignment,
- Evaluation.

Benefits for the plant: Assignments are clearly defined and crisis management preparedness is more efficient.

Benefits for the operators (recognition, improvement of working conditions, etc.): The co-coordinator may use this letter to rely on the heads of command posts. Each head of the command posts has enough time with the agreement of his line management to carry out his assignment.

Sharing of experience with other plants: Assignment letters were disseminated to the other EDF NPPs to share this experience.

Safety: Improvement of the NPP crisis management.



**9.2(b) Good practice:** Redundancy of EPP equipment and procedures.

There is a lot of redundancy in the equipment and procedures of the emergency plan, because the plant applied wherever possible the principle of redundancy in emergency preparedness.

There are numerous examples of where arrangements and equipment used in an emergency are doubled up. In particular:

- telecommunications which are systematically and independently doubled up,
- certain computer tools where a paper-based back-up is planned for.  
Examples include applications used by the assessment command post (PCC) and the staff accountability system used at the gathering points,
- there are at least two sealed examples of each procedure in each command post,
- the barrier analysis that is done by the ETC during an emergency is checked by the ETC-N in Paris;
- systems for calling up staff either at the plant or on call are doubled up and independent.

Advantages for the plant: This redundancy improves the reliability of the EPP organization.

Operational safety: Improves the way an emergency is handled by the plant.

**9.2(c) Good practice:** Colour coding used on assessment sheets (Fiche “évaluation des conséquences radiologiques”) in the emergency command centre

The tables in the assessment message sheet that has to be completed by the Site Assessment Emergency Centre (PCC) has the same background colour as the guideline (called KGE) that is used to assess the situation. This reduces the change off mistakes, especially in stressful situations.

This change was suggested by the Penly staff during a training session.

Colour codes used in the “release forecast and monitoring” message sheet comply with the colours used in the KGE guideline and in the computer application:

- blue for the total amount of radioactivity liable to be released in the next 24 hours;
- yellow for the estimated consequences to the public.

In addition, protective measures for the public and plant personnel are displayed in the Command Centre that are also compliant with the colour coding principle:

- blue for the protection of workers;
- yellow for the consequences calculated on the basis of the radioactivity to be released within the next 24 hours.

Benefits for the plant: This way the corporate message template is maintained.

Benefits for the emergency organization: The colour coding gives visual reference points making it easier to copy documents and reduces stress levels associated with emergency situations. Nuclear safety: Reduces copying errors. Improves reliability of information sent to the public authorities, as part of the protective measures taken to protect the public.

#### 9.4. EMERGENCY RESPONSE FACILITIES

**9.4(1) Issue:** When the personnel on site are notified to go to an EPP assembly point, there is no possibility to determine, in a timely manner, the persons on the site that are unaccounted for.

At the assembly points the persons on the site get accounted by scanning their badge number into a local computer that sends this information to a central database in the Local Logistics Emergency Centre (PCM). There is however no feature in this database to compare the list of accounted people with the current list of people on the site, due to the concern about confidentiality. This current list of people on the site is in the Site Protection database (called KKK system) of the Site Protection Centre (PCP) and it gets automatically updated every time a person passes the main entrance with his or her badge. The content of the KKK system and the current list of people on the site are confidential, even the plant manager can only look at it in presence of trade union representatives (the only exception to this rule is an event of intrusion). This means there is no direct link between the KKK system and the accounting system in the PCM, what makes it impossible to generate an unaccounted list automatically. Due to the prohibition of the use of the KKK information and the rules that have to be obeyed in order to use even a hard copy of this information, there will be no timely detection of unaccounted persons. Exercise results show that it will take up to 3 hours to make a list of the missing people. The assembling of people therefore relies almost completely on the self rescuing of people. Unaccounted people will not be recovered in a timely manner and can therefore not be given immediate first aid if needed. Activation of each assembly point is done manually on the spot by an assembly manager (one for each assembly point), which can cause additional delay, see suggestion 9.4 (1).

Without a timely detection of unaccounted persons on the site during an emergency, injured, disabled, trapped persons or those missing the announcement that are not able to go to an assembly point (in time) will not be recovered nor receive necessary medical treatment in a timely manner.

**Recommendation:** The plant should in case of an emergency, timely determine the persons that are not accounted for. The information of the unaccounted persons should in case of an emergency be timely available for the emergency organization to recover the missing persons and give them immediate first aid if needed.

One way how a timely determination of the missing persons could be realized is when the current information in the KKK system of people on the site is compared with the list of people that have been accounted for. In some other power plants this is done by a computerized system that generates a list of missing people. In these cases the information from the gathering points is automatically compared with the information of the security system. The power plant would in order to be able to implement the suggested solution, need to get agreement on an additional exception to the confidentiality of the security information. This should be easy defensible by plant management as the safety of the workers on the site is considered to have an overriding priority to their privacy.

**Basis:** IAEA Safety Standards GS-R-2 sec. 4.51.

## **Plant response/action:**

Our response to this recommendation can be described at two levels and according to two different time scales.

### ▶▶ **Addressed locally by the plant:**

The OSART mission prompted us to review the matter and supplement our local set-up.

The three categories of staff not called to head for muster points are required to register their presence in addition to the computerised counting system, something that did not exist at the time of the OSART mission. The three categories comprise:

- ✓ On-shift operations staff: In the control room of each unit.
- ✓ Site security staff, with a supervisor being informed of those assigned to site reception or security duties.
- ✓ EPP staff members called to the safety building, the medical centre and the emergency support facility are also accounted for within an hour, and command centre managers are required – as part of emergency regulations – to announce that their command centre is manned and if necessary to name people who are missing.

These measures are being applied and are an effective additional means of accounting for staff.

### ▶▶ **Corporate level**

Following the OSART mission, the site sent a letter to the DPN associate director for nuclear safety, as the response to this recommendation required a corporate decision. Indeed, the use of the entry control system is a substantial investment and concerns all EDF sites.

The corporate emergency organisation department, which establishes current policy for all sites, has indeed addressed Penly's request via :

- ✓ Policy procedure D4510 NT BEM ONC 05 0077 entitled "Muster point management – Review of practices on EDF and international NPPs", which recognises the need to initiate an investigation.
- ✓ Guideline D4510 NO BEM ONC 05 0227 entitled "Emergency activities 2006-2008", which incorporates the investigation into the schedule as of 2006

Investigation results are expected by the end of 2006. This will respond to suggestion S9.4(2)

## **Reminder**

Penly's EPP structure is in line with corporate EPP structure. It responds within one hour and at a higher level of response than simple muster point activation. A qualitative count is taken

and people are profiled for first-aid skills, technical specialities and EPP call-up duty, in order to be able to call on staff with the necessary crisis management skills.

### **IAEA Comments:**

The plant initiated in a timely manner a revision of the existing practice for accounting of people in an emergency situation by sending a letter to EDF corporate organization in January 2005. In this letter the plant explained that it would not be appropriate to implement the technical modification to use KKK system for emergency accounting before it is ensured that the data generated could be legally accesses for the desired purpose. At the same time the plant expressed its opinion that safety of people in case of emergency might have higher priority than the respect of their rights for privacy.

EDF corporate organizations provided several responses to this inquiry:

- Policy procedure on “Muster point management” in April 2005;
- Guideline on “Emergency Activities 2006-2008 in March 2006;
- Minutes of the meeting organized by CAPE CESI on 23 March 2006.

Reviewing these responses it can be concluded that the goal set by EDF corporate organizations is to be able to account for people in 30 minutes after the notification of an emergency. Several options to reach this goal will be analyzed to determine their efficiency and cost impact. The solution selected after this analysis will be applied at all EDF plants. The deadline to report the results of the feasibility study is 16 November 2006.

However at first sight this schedule of actions may appear not very ambitious, but considering the size of the EDF fleet, the desire to apply standardized process for accounting of people across all plant sites during emergencies and the cost impact of implementing the new methods for accounting it still can be judged as acceptable.

Meanwhile the plant has implemented local improvements to accounting for staff present at site but not required to assemble at muster points.

**Conclusion: Satisfactory progress to date.**

**9.4(2) Issue:** Activation of each assembly point is done on the spot by an on duty assembly manager (one for each assembly point) and could, outside normal working hours, take up to 65 minutes to be completed, which is not in a timely manner.

The time needed to get on duty emergency personnel outside normal working hours, on the site can be up to 60 minutes after the notification of an emergency. After the moment the assembly manager has reached his assembly point, he needs about five minutes to start up the local assembly point computer that is installed on every assembly point. After that the people will be accounted for by scanning their badge information into the local computer. The monitoring of the radioactivity at the assembly point will also not start earlier, because it is done with a handheld measuring device used by the assembly point manager. This means that a total of 65 minutes can have elapsed before the assembly points are activated and the accounting for persons and radiation monitoring of the assembly points will start. Although the activation of the assembly points can be done within the time that is prescribed by the French regulator, it is relatively long compared to some other power plants. IAEA-EPR-METHOD 2003 Table A14-II also indicates that 15 minutes after declaration of an emergency should be strived for as the time that is needed for the activation of the assembly points. The way the accounting for persons is organized at this moment, can however not guarantee a much shorter time than 60 minutes. When the determination of the missing people would be fully automated, it would mean that the list of missing people could be already available at the moment the PCM arrives in the command post. Due to this the PCM could start immediately recovering the missing people.

Without a timely activation of the assembly points, the accounting for persons on the site and the monitoring of the radiation at the assembly points could start very late after the notification of an emergency.

**Suggestion:** The plant should consider activation of the assembly points in a timelier manner.

A possible solution could be that the accounting is fully automated. For instance when the accounting at the assembly points could be done by scanning the badges of the gathered people into a computer database, without interference of an on duty assembly manager. If this information were after that compared with the KKK list of persons by a computer, then it would be possible to have a quick determination of the missing persons.

**Basis:** IAEA-EPR-METHOD 2003 Table A14-II (updating IAEA-TECDOC-953).

#### **Plant response/action:**

The outcome of this suggestion is directly linked to the way the recommendation 9.4 (1) is addressed.

The study into the use of the plant personnel badge accounting system (called 'KKK') will address the issue raised by this suggestion, namely accelerating counting methods at assembly points.

**IAEA Comments:** See the IAEA comments to issue 9.4(1).

**Conclusion:** Satisfactory progress to date.

**9.4(3) Issue:** The escape routes from the production buildings to the assembly points are not clearly marked because the signs are not consistent and they do not fully comply with international symbols. This could cause confusion in stressful emergency situations.

The EPP gathering points for the gathering of personnel in case of an emergency are well identified by the applicable international symbol at the gathering points itself. The signs pointing to these gathering points (in the halls and stairways, pointing in the direction of the assembly points) however are in plain French text without a symbol. The signs pointing to the exits in the stairways that are meant to be safe escaping routes from the turbine halls do also contain only plain French text and no international symbol.

Without consistent, internationally used signs people can get confused in an emergency situation which could jeopardize their safety.

**Suggestion:** The plant should consider replacing all text signs that are meant to guide people in emergency situations by signs with the applicable international symbols. The plant could include the application of international signs into the frame of the ongoing programme of replacing the existing signs (labels) for rooms of industrial buildings.

**Basis:** IAEA Safety Requirements GS-R-2 sec. 4.51.

#### **Plant response/action:**

#### **Signs indicating routes towards each muster point have been reviewed.**

Signs indicating routes towards muster points 3 and 4, located inside the BW operations buildings, have been modified. These muster points are located in the RCA changing room at the 9.9 meter level, on both units.

Signs have been improved and now indicate the route towards these muster points.

Signs consist of two aspects:

- ✓ An international symbol indicates the level shown on the boards listing the various levels in the BW buildings ;
- ✓ A visual diagram, using an international symbol, indicates the route towards the muster point.

The old boards with instructions in French on how to reach muster points 3 and 4 have been removed. The routing sign towards the 4 other muster points located close to the entrance of the identified buildings and on the ground floor have had the international symbol added to them.

#### **IAEA Comments:**

The tour to the radiation controlled area of unit 2 has confirmed that the signs related to the emergency assembly points have been systematically replaced in order to apply internationally accepted pictograms.

**Conclusion: Issue resolved.**

**SUMMARY OF STATUS OF RECOMMENDATIONS AND SUGGESTIONS  
OF THE OSART MISSION TO PENLY - MAY 2006**

	ISSUES PROPOSED	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS	WITH- DRAWN	TOTAL
Management, Organization, Administration	R : 1		1			R : 1
Training and Qualification	R : 2 S : 1	1	1 1			R : 2 S : 1
Operations	R : 2 S : 4	1 2	1 2			R : 2 S : 4
Maintenance	R : 1 S : 2	1 1	1			R : 1 S : 2
Technical Support	S : 1		1			S : 1
Operating Experience	R : 1 S : 3	3	1			R : 1 S : 3
Radiation Protection	S : 3	2	1			S : 3
Chemistry	S : 1		1			S : 1
Emergency Planning and Preparedness	R : 1 S : 2	1	1 1			R : 1 S : 2
TOTAL R (%)	R : 8 100 %	3 37,5 %	5 62.5 %			R : 8 100 %
TOTAL S (%)	S : 17 100 %	9 53 %	8 47 %			S : 17 100 %
SUBTOTAL	25 100 %	12 48 %	13 52 %			25 100 %



## DEFINITIONS

### DEFINITIONS - OSART MISSION

#### **Recommendation**

A recommendation is advice on how improvements in operational safety can be made in the 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'.*

#### **Good Practice**

A good practice is an indication of an outstanding and proven performance, programme, activity or used equipment markedly superior to the 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. 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 works well at the plant. However, it might not be necessary to recommend its adoption by other nuclear power plants, because of financial considerations, difference 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 (Safety 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-C/SG-Q**; Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations (Code and Safety Guides Q1-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)

### *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

**TECDOC-744;** OSART Guidelines 1994 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, EDF and the plant staff provided valuable support to the OSART mission and OSART Follow-up visit to the Penly 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 Penly 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, communications manager and administrative staff was outstanding. Their help was professional and appreciated by the team.

## TEAM COMPOSITION OSART MISSION

### **LANGE, David**

IAEA

Years of Nuclear Experience: 32

Team Leader

### **VAMOS, Gabor**

IAEA

Years of Nuclear Experience: 26

Deputy Team Leader

### **NANO, Jan**

Bohunice NPP, Slovak Electric, Slovakia

Years of Nuclear Experience: 28

Review area: Management Organization and Administration

### **ERIKSSON, Lars**

KSU AB Ringhals, Sweden

Years of Nuclear Experience: 34

Review area: Training and Qualifications

### **CLEARY, Timothy**

Progress Energy, Brunswick NPP, USA

Years of Nuclear Experience: 27

Review area: Operations 1

### **SANTOS, Marco Aurelio**

Eletronuclear S.A., Brazil

Years of Nuclear Experience: 21

Review area: Operations 2

### **THAW, Ray**

Bruce Power PPL, Canada

Years of Nuclear Experience: 27

Review area: Maintenance

### **GLEDACHEV, Yonko Stoyanov**

Nuclear Regulatory Agency – Bulgaria

Years of Nuclear Experience: 29

Review area: Technical Support

### **WERDINE, Humberto**

IAEA

Years of Nuclear Experience: 29

Review area: Operating Experience

### **KOCKEROLS, Pierre**

Joint Research Centre, Qualified Expert, EC, Belgium

Years of Nuclear Experience: 21

Review area: Radiation Protection

**TAKAHASHI, Toshihiko**  
Hokuriku Electric Power Co., Japan  
Years of Nuclear Experience: 19  
Review area: Chemistry

**KRIJGER, Hans**  
EPZ, The Netherlands  
Years of Nuclear Experience: 15  
Review area: Emergency Planning and Preparedness

**SENGOKU, Katsuhisa**  
IAEA  
Years of Nuclear Experience: 14  
Observer

**HUANG, Fang**  
IAEA – TC Fellowship (China)  
Years of Nuclear Experience: 15  
Observer

**TERESTCHENKO, Alexander**  
Novovoronezh NPP, Russian Federation  
Years of Nuclear Experience: 30  
Observer

**MELNIKOV, Bogdan**  
Concern Rosenergoatom, Russian Federation  
Years of Nuclear Experience: 11  
Observer



## TEAM COMPOSITION OSART FOLLOW-UP VISIT

### **LANGE, David**

IAEA

Years of Nuclear Experience: 33

Team leader

Review areas: Management Organization and Administration, Training and Qualifications,  
Operating Experience Feedback

### **VAMOS, Gabor**

IAEA

Years of Nuclear Experience: 27

Review areas: Technical Support, Radiation Protection, Chemistry, Emergency Planning and  
Preparedness

### **CLEARY, Timothy**

Progress Energy, Brunswick NPP, USA

Years of Nuclear Experience: 28

Review areas: Operations, Maintenance