



**REPORT**  
**of the**  
**OPERATIONAL SAFETY REVIEW TEAM**  
**(O S A R T)**  
**MISSION**  
**to the**  
**BLAYAIS**  
**Nuclear Power Plant**  
**FRANCE**  
**2 - 18 May 2005**  
**and**  
**FOLLOW UP VISIT**  
**6 – 10 November 2006**

**DIVISION OF NUCLEAR INSTALLATION SAFETY**  
**OPERATIONAL SAFETY REVIEW MISSION**  
**IAEA-NSNI/OSART/2005/131F**

## **PREAMBLE**

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of the Blayais 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. Each recommendation, suggestion, and good practice is identified by a unique number to facilitate communication and tracking.

This report also includes the results of the IAEA's OSART follow-up visit which took place 19 months later. The purpose of the follow-up visit was to determine the status of all proposals for improvement, to comment on the appropriateness of the actions taken and to make judgements on the degree of progress achieved.

Any use of or reference to this report that may be made by the competent 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 basis for the evaluation. The OSART methods involve not only the examination of documents and the interviewing of staff but also reviewing the quality of performance. It is recognized that different approaches are available to an operating organization for achieving its safety objectives. Proposals for further enhancement of operational safety may reflect good practices observed at other nuclear power plants.

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

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

The report that follows presents the conclusions of the OSART review, including good practices and proposals for enhanced operational safety, for consideration by the Member State and its competent authorities. It also includes the results of the follow-up visit that was requested by the competent authority of the Government of France for a check on the status of implementation of the OSART recommendations and suggestions.

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## INTRODUCTION AND MAIN CONCLUSIONS

### INTRODUCTION

At the request of the Government of France, an IAEA Operational Safety Review Team (OSART) of international experts visited the Blayais Nuclear Power Plant (NPP) in France, from 2 to 18 May 2005. The purpose of the mission was to review operating practices in the areas of Management Organization and Administration; Training and Qualification; Operations; Maintenance; Technical Support; Operating Experience, Radiation Protection; Chemistry; and Emergency Planning and Preparedness. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

Blayais NPP is located on the right (East) bank of the Gironde Estuary, half way between Bordeaux and Royan, France. The Blayais plant has four CP-1 reactors (900 MWe) that were commissioned between 1981 to 1983. The workforce is comprised of 1305 employees with an average age of 41, and 500 full time contractors.

The Blayais OSART mission was the 131st in the OSART programme, which began in 1982. The team was composed of experts from Brazil, Bulgaria, Canada, the Czech Republic, Finland, Japan, Slovak Republic, Slovenia and the United States of America along with the host plant peer and the IAEA staff members. The collective nuclear experience of the team was approximately 300 years.

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

Throughout the review, the exchange of information between the OSART experts and plant personnel was very open, professional and productive. Emphasis was placed on assessing the effectiveness of operational safety rather than simply on the content of programmes. The conclusions of the OSART team were based on the plant's performance compared with the IAEA Safety Standards and best international practices.

### MAIN CONCLUSIONS

The OSART team concluded that the managers of Blayais NPP are committed to improving the operational safety and reliability of their plant. This commitment was clear when observing the improvements in plant conditions, work being performed and discussions with plant staff. The team found good areas of performance, including the following:

- The professionalism and strong skills of the managers and staff which is enhanced by a blame free environment
- The management initiatives and tools to achieve rapid and broad improvements in improved plant conditions over the last several years

- The dedicated leadership by senior management to control safety related work coupled with a strong programme of risk analysis covering a broad scope of activities
- Decision making techniques in important risk related topics
- Good use of performance indicators in training along with a good competency mapping system
- A good programme for operations staffing and succession planning
- Good supervision and use of contractor personnel
- Good “Index” application for sharing operating experience among engineering groups
- Good ergonomic arrangements for emergency facilities
- A willingness and open attitude of all staff to improve performance to best international standards.

The team offered a number of proposals for improvements in operational safety. The most significant proposals include the following:

- Despite the improvements at the plant in the last several years, there continues to be some problems associated with enforcement in the field of management expectations
- The material condition of the plant needs to be further improved
- The foreign material exclusion practices at the plant needs improvement
- The labelling of system components needs to be improved
- The use of operator aids needs to be better controlled
- Operations management expectations to improve human performance in the MCR and in the field needs to be improved
- As the material condition of the plant improves, plant management should seize the opportunity to continue to raise standards and improve plant patrols across the entire site
- Surveillance test procedures and activities can be improved
- There should be a more integrated approach to the application of all available operating experience information
- Radiation protection technicians and workers need to apply ALARA standards more consistently.

The team noted that the Blayais plant has initiated a number of improvement initiatives, which are commendable. Two years ago the plant showed weaknesses in many areas of general housekeeping and material condition. Today, many improvements can be seen in these areas. The team provided recommendations and suggestions in some areas where the plant has already embarked on aggressive improvement activities, but needs to keep a strong focus and momentum for these activities to reach best international standards.

An important element of the OSART review is the identification of those findings that exhibit positive and negative safety cultural aspects of operational safety performance. The team concluded the following:

The most significant positive safety culture attributes observed by the team during the review are:

- The plant staff demonstrated an open and remarkable transparent attitude in respect of their work activities;

- The team has noted a strong willingness of plant management and staff to improve plant performance from the point of view of many aspects of safety: nuclear safety, radiation safety, environmental safety and also availability of systems;
- Strong adherence to Technical Specifications observed throughout the review demonstrated a basic prerequisite for safe operations.
- There are no budget or manpower constraints to assure safe operations.

The team also identified several areas where the management and staff of the plant are encouraged to continue to enhance safety culture. These include:

- Improve implementation of radiation ALARA concepts and industrial safety work practices
- Continue to provide further management attention to improve the housekeeping and material condition of the plant
- Provide additional coaching to management and staff conducting plant patrols to further identify and correct plant deficiencies

The team recognises that several actions are already in place to address some of the above proposals. The Blayais NPP management expressed a determination to improve in the areas identified by the team and indicated a willingness to invite an OSART follow up visit in about eighteen months.

### **BLAYAIS NPP SUMMARY SELF ASSESSMENT FOR THE FOLLOW-UP VISIT**

The OSART review conducted at Blayais NPP in May 2005 was seen as a highlight by all plant staff, thanks to the credit we were given for our good practices as well as the depth and insight of all areas for improvement identified by the international team of reviewers. The “OSART” label is an extremely useful tool for boosting staff motivation on the strength of the good practices identified during the mission. As far as recommendations and suggestions are concerned, it is a catalyst which drives the implementation of corrective actions.

One of plant senior management’s primary objectives is to “sustain the momentum created by the OSART”, by setting up an OSART follow-up project, coordinated by the plant senior advisor on safety and quality, with the same people who helped to prepare the OSART mission. Progress has been regularly monitored by the plant manager and associate directors, as well as through reviews conducted by plant committees and inspections in the field, in order to ascertain that corrective actions have been properly implemented.

A great deal of effort has gone into addressing the 11 recommendations and 15 suggestions, while also getting plant staff and contractors to make their contribution. This document sets out the actions taken in response to proposals made by the reviewers and our own staff, in order to address the recommendations and suggestions. The OSART follow-up mission will provide an opportunity to assess what we have achieved so far.

Our OSART follow-up actions have been incorporated into the plant’s key projects in order to sustain them over the long term. These particularly include the major “Human Performance” project.

Our good practices are implemented on a daily basis and some are being modified in order to improve them or broaden their scope. For example, the documented operational safety



decision-making process has been extended, in 2006, to include decisions taken by shift managers, and has been directly incorporated into the electronic shift log.

The OSART has been a fantastic opportunity for improving plant condition. Indeed, year 2005 saw us featuring among the top 5 plants of the EDF fleet. In order to continue improving, we have initiated a programme to completely refurbish run-down areas of the plant as part of the project entitled “exemplary plant condition”. This programme, which was allocated a budget of more than 3.5 million Euros in 2006, with a projected budget of 50 million Euros for the period of 2007 to 2011, should enable us to achieve our goal of bringing our plant up to the standard of the best plants within 5 years.

Since 2004, a cultural evolution has already been well underway to roll out the human performance programme, with the implementation of pre-job briefings for activities involving a potential scam risk. In 2006, 2007 and 2008, the Human Performance project will take us another step further:

- Management presence in the field, aimed at enforcing rules and dealing with worker difficulties, has been stepped up and structured,
- Error prevention tools : The 3 main ones (pre-job briefing, 1-minute pause and debriefing) will be rolled out at the end of 2006; the remaining 3 (self-checking/peer checking/three-way communication) will be rolled out by 2008.

For the year 2006, we have four main aims:

- Make a success of the OSART follow-up mission,
- Consolidate the progress made in 2005 in the areas of operational safety and industrial safety to figure among the best quartile of EDF nuclear plants,
- Continue to assess our organizational set-up, including regrouping of work teams and the instigation of team projects so as to improve operational performance,
- Exerce effective control over our budget in order to reinforce our investment.

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

The team of the follow-up visit performed an in-depth review of the actions taken for each recommendation and suggestion. The plant actions in response to the most significant OSART proposals are the following:

- Management expectations are being redefined for topical areas in an easy to understand format. Management presence in the field has been significantly improved compared to 2005, and further improvement is planned. Zero tolerance and a plant wide, uniform approach have been declared in relation to certain behavioral deficiencies.
- Long terms plans and action plans have been established to allow for the continual improvement of material conditions. But ongoing plans and projects are launched, and feedback from different projects needs to be periodically evaluated and afterwards implemented.
- The systematic approach of the plant to the foreign material exclusion issue has resolved the issue and raised the awareness of personnel regarding the importance of proper behavior in the area of FME practices and increased the professionalism of staff.

- Good progress has been achieved in the system for the continual improvement of labeling, especially the labeling for big items of equipment. But the quality of labeling can be improved through ongoing long term plans of further improvement.
- The operation organization has successfully improved the process regarding the use of operator aids, including an organization and continual checking system. Good progress in the implementation of operator aids has been achieved.
- The system for improving human performance in the main control room and in the field has been reinforced. The plant has enhanced performance in human error reduction areas, other aspects of human performance are covered by long-term plans.
- The plant has enhanced the system for continual improvement of identification and reporting of low-level deficiencies in the field. However discrepancies can still be identified, as seen through deficiencies noticed by the team during walk downs.
- On the surveillance activities, diagnosis of the deficiency was made and action plans were developed. At the time of follow-up visit, about 95% of these action plans were implemented. As a result, performance on surveillance activity have improved.
- The plant developed two good tools in addressing the issues in the OE area. They are designed as quite user friendly and make further analysis easy. Based on these tools, the trend analysis are planned every six months. The action plan to involve the whole plant personnel in this project is considered by using human performance coordinator, however, the plant still needs time to develop a concrete action.
- The plant provided an analysis and an action plan was drawn up. Understandable reference standards have improved staff knowledge, have supported plant expectations and they deal with the following topics: radiation protection signage, exiting the RCA, radiological work permits, jobs with potential contamination risks in the RCA.

In summary, short term responses have been successfully completed. Concerning those responses which due to their nature have a longer implementation time than the period between the OSART mission and the follow-up visit, appropriate projects have been launched and a very significant effort has already been made. Naturally these efforts need to be sustained in order to achieve a major change in attitude and performance

## **1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION**

### **1.1. ORGANIZATION AND ADMINISTRATION**

The plant has started to work in a new organization since March 1, 2005. It is very difficult to evaluate the capability of this new organization but some basic reasons for this modification can be evaluated and also a general view about the new organization can be described. The previous organization consisted four divisions and the structure was simple on paper with similar functions divided into many organizational units. Each unit had quite independent positions and their own documentation including procedures. This made cooperation complicated and common goals difficult to reach.

The new organization is a matrix type organization where all similar tasks are gathered under one management who is responsible for the quality and safety of its activities and who also drives the performance. There is a specific organization for outages called “outage project” and another for operation called “operation project”. Today’s structure looks to be clear. The plant manager is responsible for 16 departments; with which he signs business plans. The plant manager has 26 subordinates directly reporting to him, which may cause some problems.

The new organization had been well studied before its establishment and there has been good communication on it since the beginning of 2004. The large organization modification was carefully planned and implemented. All plant personnel were informed well ahead and trade unions and the Safety Authority were participating strongly in the process. The nuclear safety department remained practically untouched to avoid disturbing the department responsible for independent checking during the transient situation. Today, responsibilities are clearly described in the QA manual and business plans and are well understood.

At the plant there are abundant human resources which were not reduced by the organization modification. Financial resources are strongly dependent on EDF headquarters. Modifications or other investments are mainly decided in Paris.

EDF has corporate level objectives, part of them are for all the fleet and some only for Blayais NPP. In addition, the plant manager has his own personal objectives and these three groups together, form the Plant Managers objectives in the business plan. The plant manager monitors all these objectives every month and company’s headquarters review the reports twice annually.

The plant is extensively using contractors to perform refueling outages, maintenance works and modifications. The main contractor can be considered to be the Areva group who was the main supplier during construction. There are also other contractors and Areva and others can use subcontractors. The contracts are increasingly long-term contracts (3+1+1years) and partly short term for temporary or short-term works.

EDF sets specific demands for the training of contractor staff. The contractor is responsible for ensuring that its personnel know and apply industrial safety rules. To make progress, Blayais NPP created an inter-enterprise group, now made up of 75 firms, which informs, trains and performs checks in the field in the area of industrial safety, radiation protection and quality assurance. Contractors also prepare the risk analysis for each job which is checked by the plant. The plant or the corporate technical support department (UTO) department will

purchase spare parts and then provide them according to the needs of the contractors. The tasks and responsibilities between the plant and contractors are well arranged and are appropriate.

The plant has a clear policy for industrial relations, qualification and evaluation of contractors. EDF's headquarters has a strong role in this process. Contractors' use is so well organized that it can be regarded to be strength.

The relations with the regulatory body and plant management are confirmed by both sides to be professional and correct.

The plant has closed the information center because of a national decision based on security, however, the plant is keeping close contacts with local people and politicians. The plant's communication department has three main activity areas. First is to help management in all communication, second is take care of internal information and help other managers in this area and the third topic is to ensure readiness to take care of external communication in case of possible crises. The plant's communication department has had a hard task after the 1999's flood to recover the lost credibility, but now the situation is considered to be good again.

## 1.2. MANAGEMENT ACTIVITIES

The plant manager's statement (QA manual No 1) sets the ambition and the eight policies that show the challenges, goals and the principles for each area, in particular nuclear safety, industrial safety, management and control. Each department has its own business plan, approved by the plant manager, which defines the priority actions and goals for the year.

All sixteen departments have their own bulletin about key performance indicators where results and history curves are visually well presented. Some departments also have weekly reports allowing for quick follow up and response possible.

The managers at the plant have informal relations with the staff and communication looks to be easy.

The culture of the plant is generally very open which makes communication natural.

At the plant there are specialists for human factors. They participated strongly in the organization change.

The plant has developed a common approach for making important risk related decisions. This includes standard topics to be discussed and decided. The systems' goal is to take into account important areas and this protocol is stored so that each important decision is available for tracking. The team considered this decision making process as a good practice.

There are some areas of weakness in the field activities including material condition of the plant. Because of their common features the team has made a recommendation regarding following management expectations.

### 1.3. MANAGEMENT OF SAFETY

The safety policy is clearly stated in the plant manager's declaration (QA manual no. 2). The management has also allocated enough resources for controlling the safety related tasks and the general safety status of the plant.

However, the personal presence of management on the field could be increased. The problem of insufficient presence can be partially based on an abundant meeting 'culture' of the plant.

On the other hand there are clear signs like "Industrial Safety Mornings" which show this participation of management staff. "Industrial Safety Mornings" can be considered as a good practice.

Safety performance is monitored well and the informative picture produced by the Safety and Quality Department describing the existing situation can be seen in many places at the plant.

Assessments are made on many levels starting from shift supervisors, safety engineers on duty up to the plant manager. To increase personnel's awareness about the practical safety status at the plant, the Safety and Quality Department publishes a weekly Safety and Quality bulletin, which was considered to be a good practice.

During the OSART review the team has identified several features of the plant as being characteristic for its safety culture. These features are described below:

The plant staff demonstrated an open attitude and remarkable transparency in respect of their work activities. During the OSART review the team has found that everybody was ready to discuss any type of potential problems. The "blame-free policy" established by plant management has become part of the company culture at Blayais NPP. This policy definitely has contributed to the prevailing attitude of openness and transparency and was recognized by the team as a good practice.

The team has noted a strong willingness of plant management and staff to improve plant performance from the point of view of many aspects of industrial safety: nuclear safety, radiation safety, environmental safety and also availability of systems.

Strong adherence to Technical Specifications observed throughout the review demonstrated a basic prerequisite for safe operations.

Market pressure in many countries has lead to increasing requirements of efficiency and cost reduction. From this point of view, the team was pleased to confirm that the Blayais NPP is still on the conservative side in considering human resources and economics. There are no budget or manpower constraints to assure safe operations.

Inconsistent implementation of safety practices was observed in many areas of plant activities. Inconsistency in this respect is not acceptable, because if a practice can be followed in one instance, it should be possible to be followed in others. Inconsistency also creates confusion and doubts about necessity for applying specific safety practices.

Housekeeping and cleanliness at the plant was judged as insufficient in comparison to good international standards, despite the efforts taken in the recent years to improve the situation.

Such conditions do not support maintaining an attitude of staff appropriate to the nature of the technology operated. The team recommended an improvement in this area.

Work practices do not guarantee adequate personal safety, so awareness of the staff definitely needs to be raised in this area.

The team noted that sometimes there is too much self-confidence on behalf of plant staff. This means that the attitude “only this is the right way to do it”, this cannot happen, therefore there is no need to take measures” is not in line with a questioning attitude, which is a basic feature of good safety culture.

Low alertness of operators’ rounds leads to a situation when additional management programmes have to be introduced in order to improve this poor practice. Tendency to take shortcuts is a threat that safety precautions could be bypassed. It was a general impression of the team that some rules are not well followed by plant staff, which is of course a practice that has to be changed.

The team acknowledges the management’s efforts to decrease and limit the time occupied by meetings. However, the team has the opinion that meetings could be further reduced, to make more management capacity available to be applied for being present in the field, for coaching of staff and dealing directly with improvement of plant conditions.

#### 1.4. QUALITY ASSURANCE PROGRAMME

The corporate level QA manual is the basic document in this area. However, the demands and instructions from the corporate level manual are all inserted to the plants QA manual, which can be considered a good solution. The QA manual is divided into three levels and the structure is clear. The amount of documents (181) at level two looks to be rather high. The updating of QA documents for the new organization has proceeded well. About 80% of them are already updated and the remaining are scheduled to be ready until the end of the year. The upper level documents (level 1-2) are available for everyone through plants computer network.

Upper level QA responsibility is at the corporate level in Paris. At the plant, the quality and safety department carries responsibility for integrating the requirements with the plant QA demands and for defining the organization to comply with these requirements.

There are many QA inspections and the coverage of all predetermined areas can be considered to be sufficient. In addition, there are random based audits required by managers. Deviations are detected and well reported in QA audit reports. Corrective actions are well presented, however, the scheduling and control of implementing those actions was converted from paper to a computerized application two months ago and its success cannot be evaluated yet. The system looks to be reasonable and there are no doubts for further success.

QA audits are done only by the resources of the quality and safety departments. Good international practice has shown however, that sometimes also specialists from other nuclear power plants or from other industry are invited to perform audits, for getting fresh ideas. The QA organization and programme is audited yearly by corporate level auditors which use the corporate level QA manual as a reference document.

## 1.5. INDUSTRIAL SAFETY PROGRAMME

The Industrial Safety programme is based on EDF's safety instruction document, which covers all power plants, not only nuclear. Any changes to this document will take years because it needs so many approvals including Trade Unions. Today's document is from the year 1991. Only the radiation safety instruction has been updated recently. This situation can affect negatively in improving industrial safety. At the plant level industrial safety instructions define the rules to follow and these instructions are regularly updated.

Industrial safety has improved according to statistics during the last few years and for 2005 there is a clear programme for improvements including radiation protection. However, industrial safety has room for improvement, which can be seen also in the goals of the plant in terms of industrial safety indicators. The team has made a recommendation concerning industrial safety work practices of some contractors and plant staff. The team has also made a suggestion of making some protective equipment more user friendly.

Safety requirements and signs can be seen generally enough at the plant but respect for them is sometimes in question.

The team has found a good practice concerning management's regular simultaneous presence at the plant.

## 1.6. DOCUMENTS AND RECORDS MANAGEMENT

Production of documents is the responsibility of those organizations which need them. The approval of documents is controlled in two ways. The first phase is before they are sent to documentation department and second in the documentation department where they have a checking list for detailed control including approval and issuance. After final acceptance in documentation department two safety copies are stored in two separate places. The documents are stored in documentation satellites, where needed paper copies are available as well as blank versions for entering test results in appropriate places. Printed documents have no signatures but headline text on the first page guarantees that they are current and approved.

The documentation department controls the updating schedules by producing lists of delayed updating to responsible bodies and their superiors. After establishing this practice, delays have decreased by 70%. The documentation department also delivers lists of documents, which need updating half a year earlier for the next year, so that responsible organizational units can perform an updating plan in time. However, there are still delays but the situation is improving. The documentation department has also made some checks at site to review documents presence and validity. These checks can be considered very useful based on results. The documentation department provides another service for units by producing and updating the lists of documents, which have to be updated after each unit's modifications. To coordinate documentation development the plant is using intranet between other plants and EDF's headquarter.

Documents are primarily stored in electronic form, which is valid also to all old versions and disposed documents.

## **BLAYAIS NPP FOLLOW-UP SELF ASSESSMENT**

The OSART mission conducted in May 2005 was a highlight for the managers of Blayais NPP: exposure to other practices, recognition of our good practices and the astute identification of areas for improvement observed by the reviewers.

In order to close the gap between expectations and their implementation in the field, we have stepped up management presence in the field (more than 3000 inspections in October 2006) and made it easier for workers to meet expectations by producing concise sheets setting out reference standards in each area, in order to explain our expectations in concrete and simple terms.

Improved plant and material condition is a site priority, with a budget of more than 50 million Euros allocated for the period of 2007 to 2011. Our goal is to bring the site up to the standard of the best plants within 5 years.

Adherence to industrial safety expectations is being addressed via inspections conducted in the field. More specifically, deviations from the rule governing the use of hard hats and safety shoes in industrial areas, and from the smoking ban in industrial areas, are being specifically dealt with by the appropriate department managers.

Lastly, in order to facilitate hearing protection measures, ear plugs with a flexible headband have been provided.

Getting these actions underway has been a priority for us, convinced as we are that they will help us to raise our standards daily and become more meticulous in our operational activities.

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

In the area of Management, Organization and Administration there were two recommendations and two suggestions. All of them have reached satisfactory progress to the time of the follow-up visit.

Management expectations are being redefined for topical areas in an easy to understand format called “reference sheets”. Training has been organized on management presence in the field, observation of activities and human performance / error reduction tools. Management presence in the field has been significantly improved in 2006, as compared to 2005, and further improvement is planned for 2007 and 2008. Zero tolerance and a plant wide, uniform approach have been declared in relation to certain behavioral deficiencies. In other areas, complicated arrangements not supporting good performance will be changed to facilitate better performance. In summary a very significant effort has already been made but naturally these efforts need to be sustained in order to achieve a major change in attitude and performance.

In response to the recommendation to improve housekeeping and cleanliness, plant management took several actions. Deficiencies are identified today by equipment owners, area owners and managers. The “management presence in the field” programme was modified in order to assign personal responsibility for certain plant areas among the members of the senior management team and heads of departments. Deficiencies identified in the field are dealt with in three ways: by direct intervention, by the fix-it-now team and by maintenance work orders. Improvement at present as compared to the 2005 status is already noticeable, however several deficiency tags dating back to 2005 could still be found posted in the field. The “exemplary plant condition “



project will bring significant momentum to the effort of improving plant condition. Challenging targets have been set by plant management for gradual improvement through the coming 3-5 years.

In order to improve industrial safety work practices reference standards have been clarified, however not all of them have entered into force. New types of user-friendly protective equipment were selected by consulting staff. Industrial safety mornings are organized every two months in a way that ensures communication with staff on this matter, and assessment of feedback. Several performance indicators are used to monitor progress. This indicates strong commitment by management to improve the industrial safety situation. At the same time, several examples of industrial safety risks (electrical shock, tripping hazard) can still be observed in the field.

In response to the suggestion relating to hearing protection, noise level measurements were performed in the industrial buildings and requirements were modified based on measurement results. However, staff awareness of these new expectations has not been raised yet; therefore, examples of not using hearing protection in the turbine building could still be observed during the follow-up visit. More than 1800 new, “head-band” type hearing protection devices have been issued to staff since January 2006. Further, made-to-fit, customized hearing protection devices will be made available for work in areas of increased noise levels in 2007.

## **DETAILED MANAGEMENT, ORGANIZATION AND ADMINISTRATION FINDINGS**

### **1.2. MANAGEMENT ACTIVITIES**

**1.2(1) Issue:** Management expectations are not always met by the real behavior of personnel or the status of the material conditions of the plant.

Management expectations to improve the overall status and performance at the plant have been raised during the past several years for achieving the level of international good practice, however the gap between expectations and the reality is still to be decreased.

The team has found lower performance than expected in many areas of activities. Operators during plant tours have a lack of sensitivity to observe and report small defects and deficiencies, post maintenance activities do not always leave the working place clean after work, implementation of some safety practices among others in the area of Industrial and Radiation Safety is inconsistent. The ownership of components or processes appears at a low level. In combination, these factors have contributed to the plant's material condition, housekeeping and industrial safety work practices not meeting high international standards.

The gap between expectations and reality can cause confusion and decrease the motivation of the staff thus not facilitating the speed up of further improvement.

**Suggestion:** Consideration should be given to continue to implement further actions on foreman, supervisor and management levels to ensure that working practices of personnel and status of plant equipment would better meet management expectations in striving to reach high international standards.

In other plants worldwide coping with similar problems, the following methods have been used effectively:

- Training in methods of field inspection and coaching of staff;
- Provide additional coaching to management and staff conducting plant patrols to further identify and improve human performance and correct plant deficiencies;
- Creating ownership networks;
- Setting up reference areas in the plant as examples of desired equipment status and conditions;
- Further benchmarking with plants reaching high standards in areas of interest.

**Basis:** IAEA Safety Standard NS-G-2.4 para 5.9.

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

One of safety management's priorities is to step up management presence in the field. Since the OSART held in May 2005, we have made the following improvements:

### Training provided in management presence in the field.

In June 2006, 40 managers (ranging from plant manager to foremen) attended a WANO “management presence” training course, focusing on plant and material condition. The course familiarised managers with international reference standards and encouraged departments to discuss site strengths and difficulties, with a view to improving plant condition.

First-line managers will undergo WANO training in the “observation of activities”, in order to help them monitor adherence to craft standards and detect difficulties in performing activities. The first session was held in August 2006, with the next one scheduled in December 2006 and another one for early 2007.

In addition, department managers and plant directors have been trained in human performance and error reduction tools, in order to provide the keys to effective managerial presence in the field (monitoring, support, assistance) and conditions for success (clear rules, dealing with difficulties).

### Improved effectiveness of management presence in the field.

Management presence in the field is monitored on a monthly basis. Since the beginning of 2005, the number of inspections has increased by about 50%. We now conduct an average of 300 inspections a month.

An analysis of inspection reports filed in the site’s only “management presence” database reveals a split of around 50% between findings on behaviour and craft expectations (52%) and between findings on housekeeping and plant & material condition (48%). This split reflects the real commitment on the part of managers to monitor adherence to craft expectations.

Field inspection programmes address adherence to craft expectations and undergo a six-monthly 2nd-level analysis by the department manager (for the department) and by the plant senior advisor on safety and quality (for the site). Specific corrective actions resulting from regular reviews of feedback from the field are implemented on a six-monthly basis within the departments, such as the writing of concise summaries of reference standards for specific areas, designed to help field staff familiarise themselves with and apply expectations.

### Implementation of the Human Performance Project

This major project, set up by the site in early 2006, is firstly aimed at improving operational safety performance by :

- Stepping up management presence in the field in order to monitor adherence to expectations, understand the real issues associated with working in the field, and deal with worker difficulties,
- Implementation of human performance tools to get high-risk activities right the first time, such as activities involving potential reactor scram risks and fuel handling activities. This part of the project is included in actions implemented to address the recommendation on “Human Performance in the MCR and field”.

To date, we have trained our managers (2 days, in June and September 2006) and have assigned one representative per department (the Human Performance representative) to implement project actions within the department. Project progress is reported back to the GTS twice a year, with regular oversight provided by the associate director in charge of maintenance.

Our forthcoming milestones are:

- Managers' findings on their presence in the field and difficulties encountered, in order to draw up a common set of reference standards,
- Implementation of error reduction tools (Pre-job briefings, 1-minute pause and debriefings) for high-risk activities (start of 2007 after team training and compilation of list setting out activities for which error reduction tools are needed, with input from team members),
- Setting up of a fast-track (monthly) process for reviewing and dealing with feedback from the field (progress actions to address worker difficulties or deal with recurrent deficiencies),
- Cutting down on time spent in plant meetings, in order for managers to spend more time in the field.

#### Setting up of a management-specific system for dealing with deficiencies

In order to further reduce behavioural deficiencies in the field, the site senior management committee has decided that deficiencies potentially affecting operational and industrial safety will be addressed in the same way by all departments. Since the summer of 2006, these deficiencies have to be specifically addressed by the department manager, with the worker. This applies more specifically to deviations from the following expectations :

- One-hour time limit for mobilising EPP emergency teams,
- Smoking ban in industrial areas,
- Use of safety shoes and hard hats in industrial areas,
- Marking off and signage of gamma radiography areas.

#### Creation of craft-specific guidelines for implementation of reference standards

In order to help workers familiarise themselves with expectations and rules to be applied in the field, and to help managers monitor adherence, we have created A4 summary sheets setting out reference standards in each area. There are currently about 20 sheets for our main operational safety expectations, such as temporary modifications and surveillance tests. In order to further improve worker knowledge of all reference standards, we have decided to produce craft-specific guides comprising all craft sheets. The four guides will be specific to craft rules (operations guide, maintenance guide, chemistry/environment/testing guide and industrial safety/RP guide) and they will supplement the current guide on plant and material condition. We have so far decided to create about 100 sheets, which are currently being

written. These guides should be made available (to EDF workers, contractors and managers) by early 2007.

#### Specific actions in the area of housekeeping and plant & material condition

These actions are set out in detail in paragraph 1.3.1 dealing with the recommendation on “housekeeping and cleanliness”.

#### **IAEA Comments:**

Management expectations are being redefined for topical areas in an easy to understand format called “reference sheets”. It is planned to create craft specific guidelines by compiling of more such reference sheets.

Training has been and will be further organized on management presence in the field, observation of activities and human performance / error reduction tools.

Management presence in the field has been significantly improved in 2006 as compared to 2005 and further improvement is planned during 2007 and 2008. The results of management plant tours are analysed in order to understand areas for improvement and strengths. Zero tolerance and a plant wide uniform approach have been declared in relation to certain behavioural deficiencies. In other areas complicated arrangements not supporting good performance will be changed to facilitate better performance.

In summary a very significant effort has already been made but naturally these efforts need to be sustained in order to achieve a major change in attitude and performance.

**Conclusion:** Satisfactory progress to date.

**1.2(a) Good practice:** Use of decision-making sheets in case of complicated questions concerning nuclear safety, radiation protection, plant availability and environmental protection.

Any important decision to be made in regards with nuclear safety, radiation protection, electricity generation or environmental protection area is formalized and approved by the operations or maintenance Manager or on-call Manager.

The traceability of the decision made includes the following items:

- the definition of the problem and the decision to be made;
- the persons involved in the decision making;
- the possible solutions or scenarios to be considered and the related analysis/ justifications;
- the final decision made;
- the internal and external communication to be made on the decision made.

As for examples, important decisions include the following:

- decision to shutdown the unit or to maintain the unit in operation in case of technical problem;
- decision to extend the outage duration for specific problems;

- decision to change the reactor operating mode;
- decision to reduce the power.

The decision to be made is raised by the shift supervisor or the outage project manager towards the related manager (Associate Directors or on-call Manager) and the basis for the decision making is prepared with the support of the necessary expertise (maintenance, engineering, safety engineers, RP, etc).

### 1.3. MANAGEMENT OF SAFETY

**1.3(1) Issue:** The general housekeeping and the cleanliness of the plant does not meet good international standards.

In spite of significant progress in the last two years at many areas in the plant, the team found waste material, leakages and cleanliness does not meet good international practice. In addition many old boron leakages decrease the possibility to use them as indicators. Detailed examples of deficiencies are the following:

- the soda trace on the floor 3EASRF heat exchanger room
- 2EAS03PO pump post maintenance soda around
- 3EAS 01BA soda tank overflow
- numerous old boron traces on floors and equipment
- at the bottom of turbine hall 3-4 3 pipes feeding water and dirt on the floor
- lot of dust especially in turbine halls on components and shelves
- material stored in some places on walking ways making them narrower
- room K050 pump 4EAS PO/sump 4PREO8PS glove inside the sump.

Inadequate housekeeping can lead to several types of risks: discomfort, industrial safety, contamination, unavailability and even nuclear safety.

**Recommendation:** The plant should continue to improve further the general housekeeping for avoiding unnecessary risks, strengthen the safety culture and improve personnel's vigilance at the plant.

**Basis:** IAEA Safety Standard 50-SG-Q13 para 316, Safety Report Series No: 11 para 7.1.4.

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

The “exemplary plant condition” process, aimed at rolling out the action plan across the site, has been set up. It is being coordinated by the logistics department manager.

Operational coordination of the process has been assigned to a work coordinator from the logistics department, who is assisted by a network of craft representatives. A plenary meeting of this network has been held once a month in order to discuss various issues and coordinate progress of the 42 actions.

Main actions taken:

- A fix-it-now team (tool-pouch jobs, housekeeping rounds, mapping of plant areas, etc.) has now been set up. The number of work requests and tool-pouch jobs is around 200/month. This attests to the success of this initiative,
- Plant area “owners” (operations) and equipment owners (maintenance) are now conducting their own rounds. Plant area rounds are conducted on the basis of a surveillance test (“DIV”). Deficiencies are analysed with the fix-it-now team leader and if necessary, a fix-it-now request is filed,

- A specific paintwork system has is now operational. All paintwork requests are directed towards the joint modifications structure and are dealt with specifically. A 300 000 Euro budget is allocated annually. Plant tours are being conducted. They take place every month and are assigned to members of the extended senior management team, working in sets of two, • Plant tours are being conducted. They take place every month and are assigned to members of the extended senior management team, working in sets of two,
- A cleaning contractor supervision programme has been rolled out,
- Enforcement of high standards by project structures and in particular by managers, for the processing deficiencies; detection of deficiencies by operations, as well as worksite housekeeping and close-out,
- A 1st and 2nd-level leak containment system has been set in place,
- Steps have been defined for the handover from power operations to outage and vice-versa,
- Half-days are regularly set aside for housekeeping,
- Substantive plant refurbishment programmes have already been implemented and will continue to be implemented as part of the OEEI project. Some examples : filling in of cracks in pump house, units 3 and 4 (150 000 Euros), repainting of floors , etc..

#### “Exemplary plant condition” project

The aim of the EDF “exemplary plant condition” project (OEEI) is for all sites to have achieved a high standard of plant condition compared with plants around the world, within the next 3 to 5 years.

On average, Blayais’ current level of plant condition lies between 3 (satisfactory) and 4 (standard), far removed from the best international standards. Blayais is aiming to achieve level 2 (good) within 3 years and level 1 (excellent) within 5 years.

On the whole, it is hoped that the OEEI project will :

- Bring about progress in performance within a short period (3 years/5 years),
- Create conditions for sustaining plant condition standards over the long term.

The project is being rolled out at the site under the supervision of an operational coordinator, in charge of interfacing with corporate project representatives during the first phase (budget). During the implementation phase, he will be assisted by the craft representative network in each area.

Funding (CAPEX) has been provided in order to refurbish the equipment and installations in each area covered by the reference standards :

1. Industrial buildings,
2. Painting,
3. Electricity,
4. Mechanical equipment condition, seismic protection, corrosion,
5. Signage, labelling, signposting, tag-outs, graffiti,
6. Housekeeping,
7. Offices building,



8. Circuit integrity, leaks and monitoring in the field, containment,
9. Industrial safety, RP equipment, fire prevention, fire protection and fire fighting.

### **IAEA Comments:**

Deficiencies are identified by equipment owners, area owners and managers within the framework of the “management presence in the field” programme. This programme was modified in July 2006 in order to assign personal responsibility and build ownership for certain plant areas among the members of the senior management team and heads of departments.

Deficiencies identified in the field are dealt with in three ways :

- Direct intervention for behavior problems, lack of tidiness etc,
- Minor tool-pouch type jobs (PTJ) not requiring equipment tag out are performed by the fix-it-now team (these jobs are registered in a Lotus Notes database),
- More serious jobs requiring a maintenance work order (these jobs are registered in the SYGMA database).

However several deficiency tags dating back to 2005 could be still found posted in the field. Some of the defects had been repaired but the deficiency tag was not removed, some defects could have been repaired during the 2006 outage but decision was taken to perform the repair later and some defects will be eliminated by a design modification planned for 2007.

The fix-it-now team was established in 2004 with two full time staff members and at present it comprises 9 staff.

The “exemplary plant condition “ project will bring significant momentum to the effort of improving plant condition. The budget requested by the plant for this project until 2011 is about 50 Million Euros. There is an EDF-wide intercomparison among sites including benchmarking with the best performing NPPs of the world in this field. Improvement at present as compared to the 2005 status is already noticeable. Challenging targets have been set by plant management for gradual improvement through the coming 3-5 years.

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

**1.3(a) Good practice:** Every two months, the plant’s team leaders or managers spend half a day together with their teams (own staff or contractors) discussing and analyzing activities in the field especially from industrial safety point of view.

At the end of the morning, each manager enters the gathered information into the “deficiency” database, under the section “industrial safety day”. Good practices are implemented as soon as possible and problems after the discussion with his/her team are transferred for corrective actions. A Risk Prevention Department’s hotline has been set up to assist managers if an immediate answer to a specific question is required.

Senior management involvement demonstrates the importance of the subject. An important factor is to ‘force’ management to go to the plant sometimes at the same time so that managerial expectations and control can be shown simultaneously. This kind of common activity is like a booster to increase awareness for safety topics and it

improves contacts between the management and other staff. Also actual difficulties are solved including personnel's understanding about the industrial safety.

### **1.3(b) Good practice: Safety Quality Bulletin**

At the end of the safety engineer's week on duty, the Safety and Quality Department writes up a document (Safety Quality Bulletin) summarizing the key points in the areas of operational safety, fire protection and radiation protection for that week.

The bulletin is distributed every week, being sent to 350 staff members down to supervisory level. According to the results of a poll 70% of staff has read it. The bulletin is an important tool for communicating practical everyday safety questions concerning operation, fire protection and radiation safety. It identifies the main points of the safety engineer's evaluation and it is used also by power operations steering committee. The bulletin provides a summarized overview of operational safety and gives answers to the questions raised. The bulletin has its own place for strengthening the safety culture of the plant.

### **1.3(c) Good practice: Plant management has implemented a "Blame free" culture that is open and transparent at all levels of the organization. Staff at all levels are willing to discuss events at the plant, how they recognize the need for improvement in some areas, and they are open to suggestions for improvement.**

- Operations management is willing to discuss the shortcomings of their own organization in the past. They described their own "units 1 & 2" vs. "units 3 & 4" silo mentality, and that they were working hard, within the new organization, to overcome this mentality.
- Operations staff freely admitted that, in the past, the performance at Blayais suffered because their "insular and isolated" attitude led them to disregard opportunities to learn from other plants. They are now actively participating in benchmarking trips to other plants, both in France and abroad. It is a requirement that trainee shift managers participate in at least one benchmarking trip.
- A tagging supervisor freely volunteered that, as a field operator, he had been responsible for a "wrong equipment" event in during the wrong 6.6 KV safety-related circuit breaker was racked out, thus rendering an essential Water pump unavailable for several minutes. Furthermore, the supervisor team led a field tour to the circuit breakers in question, in order to demonstrate how the error occurred.
- Members of the human factors department freely discussed the difficulties associated with implementation of a human performance improvement plan. A project outline for the plan was very candid about the issues associated with implementation.

## 1.5. INDUSTRIAL SAFETY PROGRAMME

**1.5(1) Issue:** Industrial safety rules and practices are not always followed by some contractors and plant staff.

Workers of some contractors and also some plant staff do not follow industrial safety rules strictly. It was found in many cases that industrial safety rules were not followed properly.

- In turbine halls and also in some other areas many persons were not using earplugs when it was a requirement and in some rooms earplugs were being worn when it was not a requirement.
- Hard hats were not used systematically.
- A welder was not using protective gloves.
- Eye protecting glasses were not used in a drilling work.

Without following industrial safety rules rigorously risks of injury is increased and overall respect for rules is deteriorating.

**Recommendation:** The plant should ensure that plant staff and contractors comply with industrial safety rules and practices to achieve better industrial safety.

**Suggestion:** Consideration should be given to classifying rooms according to the real noise level and need of personal protective equipment. In addition the hearing protection equipment should be comfortable and user friendly.

**Basis:** IAEA Safety Standard NS-G-2.4 para 6.56, 6.61 and Safety Series No. 75-INSAG 4 4.2.2.1 para 78.

### **Plant response/action for the recommendation:**

In order to improve staff knowledge of industrial safety expectations and improve ways of enforcing them, the following actions have been carried out :

#### Clarification of reference standards :

Rules governing the use of safety shoes and hard hats have been clarified. Failure to use this PPE was is one of the priority issues being addressed by department management.

Non-smoking rules have been clarified and on 31 May 2006, it was officially decided to prohibit smoking – as of 31 May 2007 – in all plant rooms and transit areas, with the exception of outside areas designated for this purpose. Guidance and coaching are being provided during the interim period (raising of awareness, guidance in giving up smoking, etc.).

A document on the use of personal protective equipment (PPE) is currently being approved in accordance with regulatory procedures, with distribution planned for the end of 2006. 66 sheets setting out the rules and conditions for using various items of PPE are available in the industrial safety database in Lotus Notes format.

#### Coaching of reference standards and requirements :

Two mornings devoted to industrial safety have been arranged on the topics of worksite barriers and PPE.

The industrial safety department has endeavoured to find more suitable PPE for craft-specific needs (safety glasses, gloves for I&C technicians, clothing for working in hot surroundings, hearing protection).

A member of the industrial safety senior management team participates in refresher training for contractor supervisors. This is an effective means of clarifying expectations and placing them in context. In addition, a member of site senior management participates in training close-out sessions.

Two information campaigns were conducted in February on hand protection, and in April on the risk of asphyxiation.

#### Monitoring and addressing deficiencies :

A site governing procedure has been written, setting out site practices pertaining to the handling of deficiencies by managers. In this regard, deficiencies detected in industrial areas with regard to the use of hard hats and safety shoes, as well as the smoking ban, will be dealt with by the department manager of the worker in question.

Periodic contractor reviews include a section on “behaviour and attitude towards industrial safety”, in which contractors are assessed in terms of PPE usage, for instance.

#### **IAEA Comments:**

Reference standards have been clarified, however not all of them have entered into force. Measures for ensuring adherence to some basic rules are being negotiated with trade unions. The new procedure on the use of personal protective equipment is currently being reviewed and approved by plant doctors. It will contain more specific information on different types of protective equipment.

New types of user-friendly protective equipment were selected by consulting staff and have been provided to staff. Industrial safety mornings are organized every two months in a way that ensures communication with staff on the matter and assessment of feedback. Several performance indicators are used to monitor progress. This indicates strong commitment by management to improve the industrial safety situation.

At the same time several examples of industrial safety risks (electrical shock, tripping hazard) can still be observed in the field.

**Conclusion:** Satisfactory progress to date.

#### **Plant response/action for the suggestion :**

A comprehensive survey including more than 1700 monitoring points has been carried out by the industrial safety department.

On the basis of this survey, signage will be put up and appropriate types of hearing protection will be required for different noise levels (survey carried out in liaison with the occupational health department).

In the meanwhile, headband-type hearing protection has been made available to workers for greater comfort and convenience. Additionally, additional funds are being made available for 2007 in order to equip the most affected workers with better hearing protection (custom-fitted ear plugs) and to conduct research on collective hearing protection in noisier areas.

**IAEA Comments:**

The new French regulations relating to hearing protection entered into force on 20 July 2006. In order to follow these new requirements, noise level measurements were performed at 1700 locations in the industrial buildings. The results of the measurements taken for example, in the turbine building led to the conclusion that everybody accessing this building should wear some kind of hearing protection, and those who need to stay longer than 15 minutes in areas of increased noise level should wear more effective hearing protection. However, staff awareness of these new expectations has not been raised yet; therefore, examples of not using hearing protection in the turbine building could still be observed during the follow-up visit.

More than 1800 new, “head band” type hearing protection devices have been issued to staff since January 2006, along with 6500 pairs of normal air plugs. Further, made-to-fit, customized hearing protection devices will be made available for work in areas of increased noise levels in 2007.

**Conclusion:** Satisfactory progress to date.

## 2. TRAINING AND QUALIFICATIONS

### 2.1. ORGANIZATION AND FUNCTIONS

The corporate training strategy of EDF is implemented in the plant level within the frame of Human Resources Policy. Main objectives are clearly defined and focused to improvement of human performance and achievement of the best standards of operational & industrial safety, the environment and capability.

The training process in Blayais NPP is managed by relatively complex structure called “Site Skills Development System” (SLDC). This system includes EDF entities Nuclear Operation Division (DPN), Professional Training Service (SFP) and NPP Skills Development Department (DDC). Relations between these organizations are defined in corporate and local agreements and an impressive level of coordination has been reached.

The plant manager is responsible for the qualification of plant staff. The operational responsibility for the implementation of this policy is performed by the associated director for resources and implemented by head of DDC. He has the overall responsibility to work with the other departments within the plant to ensure task analysis work files and training skills are implemented in an effective manner. The plant management strongly supports training organization with necessary resources. There is no evidence that cost reduction programmes lead to limitation of resources being made available for training and retraining staff. Succession planning is an established practice. There is excellent interface with other plant groups. Line managers are accountable for the qualification of their personnel and involved in defining the training needs.

The training and skills development principles are based on the EDF training development system. That system is not absolutely identical with the classic systematic approach to training (SAT), but contents phases, which range over all elements of the training process in strong succession with the SAT process. The system includes identification and analysis of needs in terms of skills; defining of training objectives, formalization and re-actualization of the training; engineering of training; implementation, and evaluation, satisfaction and fulfilling of expectations. The system is applied to all plant personnel and reflected to training concepts, quality of training materials and training performance. Therefore, it could be considered that a systematic approach to training is implemented on the plant. However, such principles are not always strictly followed in current practice. Miscellaneous training related activities, which are not controlled by DDC have been observed. The team made a suggestion in this area.

The plant prepares long term training plans on the basis of three-yearly training framework. The specific content of this framework are defined in annual training plans. Three types of training plans are established – plant training plan, standard training plan and individual training plan.

The plant training plan is drawn up every year for the following year. It lists anticipated courses for all NPP staff. Most of these needs are compiled as a part of the annual skills survey.

The standard training plan is drawn up for each job position and contains obligatory initial and continuous training and complementary training. The individual training plan is specific

for each employee. Training needs are defined every year during the interview between the person and their manager. Training files and tracking methods for the employees are well structured and implemented and appear to be uniform across all departments. This planning structure ensures that training is consistent with current and future needs and goals.

Training programmes for initial and continuing training are based on competency analysis and necessary knowledge and skills are incorporated. Training programmes include different types of training – classroom, simulator, laboratory, workshop and OJT. They are periodically reviewed and assessed.

A programme of shadow training is also implemented within the training structure. It enables staff to master professional practices. The programme is based on common agreement among the manager, an assigned tutor(s) and the trainee. It contains the training plan for the necessary qualifications needed for the assigned function. Evaluation is performed routinely and qualification assessment made every two years or in the meantime if deficiencies have been detected. The programme is well structured and documented.

Special project “skills mapping approach” is performed to avoid impact of possible losses of personnel due to retirement, job changes and for other reasons. Skills mapping is a tool for analysis of collective competencies and their trends and is a part of succession planning. This tool allows managers to identify availability and needs of any specific skills and to develop adequate prognosis and action plan. The team considers skills mapping as a good practice.

Training courses are given by full-time instructors of SFP and other certified training organizations. SFP instructors have a technical background in DPN. They are recruited on rotate manner from the NPP operation and maintenance departments. Exam committee composed of SFP and DPN managers assigns the instructors. The simulator instructors are recruited through set up a succession planning system for managing the careers and skills of positions Safety engineer, Shift manager and Simulator instructor. The instructors complete initial training syllabus on instructional skills, the training methods and group training. Then they attend specific modules adapted to their profile. Finally they take the last module on analysis of practices implemented. Knowledge of the technical field is acquired from initial training and experience within the frame of their previous job. As well instructors do situational training and doubling up on courses. Professional enhancement of instructors takes one year. However, such programme does not include tutors who are in charge of providing shadow training. They have not been systematically trained to coaching and training methodology. The team has suggested providing tutors with relevant pedagogical training.

All training data are stored into the plant computer information systems. Computerized tool allows on-line access to every document or specific record and facilitates overall monitoring and management of training process. Training performance indicators have been put in place on site constituting a consistent and practical whole system. These elements enable the quality and quantity of training actions to be measured. The team considers this system being a good performance.

## 2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

The training of Blayais NPP staff performs on SFP training facilities in place on NPP site. There is close co-operation among plant and local schools “Lycée Professionnel de l’Estuaire” and “CFM Haute Gironde”. In frame of joint agreement they place at plant

disposal large scale model of restricted area and relevant equipment. Some training is performed at corporate training centers.

All observed training equipment on site is in good condition. The well-equipped computer rooms are at the disposal of the training organization. However, these facilities are being used for interactive self-study training. Computer based training courses are not developed at all.

Workshops and laboratories are equipped with mockup models and real components for training on plant specific activities. As well, a variety of visual aids are available. However, there is no written procedure for periodic review and timely modification and updating of the training facilities and material when necessary, to ensure that they reflect modifications and changes made at the plant. The team made a suggestion in this area.

Several simulators are at disposal of Blayais NPP – a thermo-hydraulics mock-up, principle simulator SIPACT, three functional simulators (reactor control, secondary circuit and CVCS) and a full scope simulator.

The functional simulators with panel man-machine interface are out of date. The panels are completely not corresponding with reference unit. In fact the main application of these simulators is for initial training. They are also used to facilitate an understanding of physics phenomena. Nevertheless, the exercises include manual manipulation on switches, buttons and other instruments. Such operations could form improper vasomotor habits and could reflect to human performance problems. The plant management is clear about this situation and declared strong intention to substitute existing functional simulators with new one multifunctional simulator MISTRAL. This simulator will be provided with software model from the existing full scope simulator and touch screen man-machine interface. The screen images will be a replica of the respective equipment of the reference unit. The team encouraged the plant to realize this project as soon as possible.

Full scope simulator is equipped with software of sufficient scope to cover normal operation, anticipated transients and a range of accident conditions. The simulator premises include also replicas of emergency control room and emergency control center. They are used for simulator based emergency drills. The full set of instructor's aids is available, including automatic records of the operator actions.

The reference unit of the simulator is Gravelines 1. Updating of the simulator's model, simulator documentation and working its environment is performed on a corporate level. Such circumstances lead to some temporary discrepancies, but nevertheless, the similarity of the control rooms and behavior of systems is in compliance with standards.

### 2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

The training programmes for control room operators and shift managers are well designed and implemented. Initial training programmes are fully developed at the corporate level. They are a combination of theoretical classroom training, simulator training and OJT under the tutorship of experienced operators and the supervision of the shift supervisors. The duration of simulator training is about 12 weeks. All training is duly recorded and periodically evaluated and assessed.



The operators' career, up to shift manager level, begins from field operator and proceeds with corresponding training. This model provides operators good possibilities to gradually increase their competence.

The continuing training programmes are composed of topics selected at the corporate level, site level and from crew requests and maintains adequate knowledge and skills of operators.

The operations crews receive two weeks of full scope simulator training per year, one course concentrating on technical aspects and the other on team situational training focusing on soft skills. The analysis of the annual training feedback leads to additional training on both SIPACT and full scope simulators.

Simulator training sessions are well developed and implemented. Phases of pre-exercise briefing, simulator exercise and debriefing are clearly structured. The realism of scenarios includes use of actual protocols for communications and plant procedures. The shift manager both recommends and monitors corrective training. The operations shift crews undergo training on transients when the primary circuit is open and primary water inventory is low. The team considers development of scenarios for that mode as a good performance.

The plant develops specific simulator scenarios for assessment of safety engineer's competency and for improving coordination between I&C technical staff and operators. The team considers such form of simulator training as a good practice.

#### 2.4. FIELD OPERATORS

Field operator training are reviewed from the needs analysis phase to the conclusion of the training. Initial training programme is developed at corporate level. The simulator training of field operators is defined in document "Site intentions concerning the simulator for 2005-2007". All programmes are well structured and developed.

The training is well documented. An individual training file is maintained for each employee and contains training completed and planned, and includes safety and technical authorization certificates.

The shift manager ensures the training programmes and services are provided as necessary to the plant.

#### 2.5. MAINTENANCE PERSONNEL

The training of maintenance personnel is provided by SFP mainly nationally and on the site's facilities as well as in the technical college in Blaye. All programmes and records are maintained within the specific departments by a training representative and owned by the department head. ALARA principle training is strongly defined. In all areas present and future competence is analyzed and defined for each individual. The training files include the yearly plan, completed training, nuclear safety work classifications and the yearly plan that had been established by the employee and his manager.

Shadow training is implemented to varying extent. Each new recruit goes through the same process and assigned a shadow tutor who provides a thorough experience transfer from the experienced tutor to the trainee and allows for continuous progress reviews.

The training is well evaluated and assessed by management. All training is duly recorded and stored to computerized database.

Contracting companies are certified at corporate level. The competence needed and training of contractor's staff is specified and stays under the responsibility of contractor. Nevertheless the contractor's staff is closely monitored. Audits are performed on the contracted company and feedback from the plant and the departments determines their continued work.

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

The training and qualification programmes for technical support personnel are based on the specific needs of the power plant. They are developed at corporate level and contain local elements. Shadow training is utilized and an individual training plan is developed for each employee, which provides tracking of safety authorization as with the other departments.

Safety engineer training is based on competencies and skills and coordinated in the same manner as the other departments. It is effective and provides the necessary skills development to ensure that this oversight is a useful service to the plant.

Other technical programmes such as Radiation Protection, Nuclear Engineering and Chemistry are developed with the same task and skills base. Objectives are determined and training provided, monitored and registered accordingly. These programmes appear to be in line with the action plan that has been developed and coordinated with human resources as a part of the overall improvement process in training on the plant.

Training plan for safety related modifications has been prepared at corporate level. DDC is responsible for implementation of the plan. Training process is defined, monitored and recorded.

All training is evaluated and assessed by management. Training records are stored to a computerized database. Bilateral contacts between similar departments provide benchmark activities and effective feedback.

## 2.7. MANAGEMENT PERSONNEL

Management programme training includes skills based on feedback from personnel appraisals and management issues derived from corporate task analysis and is provided by internal and external experts.

Training and programme development was reviewed at different levels. Competencies are evaluated to ensure they are in agreement with the company's objectives and policies. The operations competencies for shift supervisor and shift operations manager are developed focusing on management skills that challenge the candidate as he/she progresses through the organization.

All management positions are reviewed against established expectations for the potential candidate and are based on assessed competencies. Another support function in choosing competent managers is an aggressive recruitment programme that is well structured and focused on specific replacement for staff leaving or potentially leaving the NPP. The

programme focuses on general management skills, such as leadership, communications, project management and coaching.

A well structured network has been set up to provide managers with opportunities to learn from more experienced colleagues. Senior management staff also could be involved to the group meetings.

## 2.8. GENERAL EMPLOYEE TRAINING

General employee training is developed based on tasks, is of good quality and is provided as a refresher routinely. This period is between two and five years depending on each specific job position. The initial training and refresher courses are developed at the corporate level and are based on good international practice.

The training includes quality assurance, radiation protection, fire fighting, industrial safety and regulations and guidelines. The scope and volume of topics and duration of training varies for different job positions.

The excellent co-operation programme between plant departments and local firefighting authorities are observed. The corporate EDF management assessed that practice is strongly positive. The team also considers implementation of that programme as a good performance.

### **BLAYAIS NPP FOLLOW-UP SELF ASSESSMENT**

In the area of training and qualifications, the OSART mission has played an instrumental role in helping us to raise our expectations and become more meticulous in our activities.

- In addressing one of the OSART suggestions, we have ensured that every worker coming on to the plant has familiarised himself with plant reference standards in the areas of industrial safety, nuclear safety and radiation protection.
- Departments now compile training packages by using standard formats to set out their training specifications.

The review also highlighted the appropriateness of solutions adopted by the site to meet needs and proactively deal with future requirements : skills mapping and succession planning, coaching and training of mentors. The suggestion on mentor skills will help us to implement French legislation passed on 04-05-04 with regard to career-long occupational training, which calls for mentors to be trained before taking up their mentoring position.

Training specifically intended for mentors and shadow trainers is now available.

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

In summary, two suggestions have been resolved and satisfactory progress has been made with the one remaining suggestion.

The Training Department has made significant progress in addressing the OSART suggestions. This has been achieved by close co-operation with other plant departments and external organisations, including the corporate organisation within EDF.

At the plant level the document “The process of integrating new workers” has been updated by the Training and Qualification Department with the cooperation of the Communications Department. This document covers all the steps for the incorporation of new workers to the plant. The first very important pre- entrance step is to provide to recruits brief safety information by means of viewing a film with respect to operational safety and quality, industrial safety, radiation protection, fire protection, ISO 14001 accreditation, emergency planning and preparedness

A specific project has been worked out on national level for adequate training, competence of individuals and regulated manner for ensuring training of tutors who ensure entire shadow training.

This extensive project has been incorporated gradually as the most important method of development and upkeep of pedagogical skills and systematic training of tutors, as well as trainers, shadow trainers, mentors, managers.

Programme for periodic review and timely modification and updating of the training facilities and training material has been established. Also this revised document has set up for each of the plant departments their responsibilities for related updating of the training facilities and training materials.

## DETAILED TRAINING AND QUALIFICATION FINDINGS

### 2.1. ORGANIZATION AND FUNCTIONS

**2.1(1) Issue:** The plant's training system is not consistently implemented for all types of training.

Miscellaneous managerial coaching activities, career development actions and various punctual communication actions of different kinds, which are not controlled by the plant training organization DDC, have been observed.

Likewise, the DDC bears no responsibility whatsoever as to the entrance instructions provided to the contracting personnel and other staff having access to the plant. This activity has been entirely delegated to the Asset Management and Protection Departments. The DDC, which should be explicitly competent, bears no responsibility thereof. Indeed, these elements led us to consider that there was no genuine plant specific training for such a target group.

Entrance industrial safety instructions are provided under the form of a video projection and a pocket safety guide. Training department is not involved in preparation of the instructions.

Despite proven training provided to the contracting personnel, the team has observed several evidence of poor compliance with industrial safety standards – bad cleanliness, misuse of hardhats and earplugs, abandoned clothes and safety protections.

Without a consistency among all aspects of the training, the individual competence enhancement system might not be fully effective and improvements of human performance may not be reached.

**Suggestion:** The plant should consider reviewing the implementation of additional training activities to identify how the training department could bring its contribution to the activities that fall outside of the scope the structured training system.

**Basis:** IAEA Safety Standards Series NS-R-2, item 3; Safety guide NS-G-2.8, items 3.40, 3.41, 4.1.

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

The plant has exhibited its expectations with regard to the monitoring and quality of information provided in the film shown to people entering Blayais NPP.

Anyone given permission to independently move about and work on the plant is provided with indispensable information on the topics of operational safety, industrial safety, fire protection and environmental protection.

Prior to being given their access badge, any contractor (outage or other) or EDF employee from another site must go through the following pre-entrance process :

- Viewing of a film focusing on operational safety and quality, industrial safety, radiation protection, fire protection, ISO 14001 accreditation, emergency planning & preparedness and adherence to reference standards, such as exemplary plant condition.

The site has approved an updated version of this film, which is currently being produced by the communication department, via the company who created the original version (Maracas). This action has been included in a procedure aimed at keeping track of training documents and mock-ups produced by the professional training department (procedure 6608/56/PCT NT : management of training materials at Blayais NPP) :

- additional information is provided via a permanent poster campaign,
- essential information is reproduced on pamphlets.

**IAEA Comments:**

At the plant level the document “The process of integrating new workers” has been updated by the Training and Qualification Department with the cooperation of the Communications Department. This document covers all the steps for the incorporation of new workers to the plant. The first very important pre- entrance step is to provide to recruits brief safety information by means of viewing a film with respect to operational safety and quality, industrial safety, radiation protection, fire protection, ISO 14001 accreditation, emergency planning and preparedness and adherence to reference standards, such as exemplary plant condition.

Additional information is provided via a presentation in the form of a booklet campaign and essential information is reproduced in pamphlets. In this way, the plant implements the additional training activities to cover all types of training. The training also includes coaching activities and site access instructions.

**Conclusion:** Issue resolved.

**2.1(2) Issue:** Individuals who are in charge of providing shadow training have not been systematically trained to coaching, training methods or assessment skills.

Shadow training relies on the experience of the current workforce. Tutors are appointed on the basis of technical knowledge and subject matters expertise. Some of them received some form of training but not in systematic manner. However many tutors have not been trained to coaching at all. There is no stipulating that tutorial skills should be compulsory taught to shadow trainers. In some departments, the shadow training is not provided with a complete set of relevant documentation.

Without a regulated manner for ensuring tutors' training skills and abilities, adequate training and competence of individuals may not be guaranteed.

**Suggestion:** Consideration should be given to include stronger formalization of the entire shadow training process and in particular, include providing tutors with relevant assessment training.

**Basis:** IAEA Ref. A Guidebook Technical report series 380, item 10.5, Safety Guide NS-G-2.8, item 5.31

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

The site has exhibited its expectations with regard to coaching via a site governing procedure (ref. D5150 NAS MQ F2 DDC 0002), available in the GED database and used by the departments. These reference standards have been drawn up by DDC in conjunction with the crafts, on the basis of corporate reference standards. It defines the roles of trainees, shadow trainers, mentors and managers, and sets out the stages of professional enhancement training.

The following actions have been taken to raise the awareness of key staff members:

- The SLDC coordinator provided awareness training to training representatives on the occasion of an SLDC seminar held on June 5th 2005,
- Coaching workshops have been held since late 2005, coordinated by a SLDC craft representative,
- In September 2006, the Professional Training Department's MHO section (human resources and organisational management) was called in to carry out a plant appraisal and provide guidance to plant shadow trainers .

In line with the plant's reference standards, this mentor professional training initiative is led by a specialised instructor (SFP). It consists of three phases :

1. Preliminary interviews conducted on the 13th and 14th September between the instructor, future or current mentors and new trainees. The aim of these interviews is to conduct an initial status check and hone training content prior to the start of the course.
2. Training – based on the exchange of experience and on the consultant's input – will take place as of the 4th quarter of 2006. Comprising two steps, the aim is to ascertain, together with the instructor, that the first phase is properly implemented in the field.
3. "Mentor network discussions". On a regular basis, the professional training department's MHO section will come to the plant to lead discussions with the mentor network. This will provide mentors with the opportunity to talk about their mentoring experiences and practices.

This will be an ongoing training action. The plant's training plan framework letter for 2007 highlights the need to provide this type of cross-generational training within the departments.

### **IAEA Comments:**

A specific project has been worked out at the national level for adequate training, competence of individuals and regulated manner for ensuring training of tutors who ensure entire shadow training. This project includes choice of tutors based on judgement of their skill ability and communication ability. Also the roles of tutors are defined and the stages of their professional enhancement training are set out. Selected tutors are educated and trained on national level. There are local "Mentors network discussions" workshops led by a specialized instructor which are from the national level. These started to be organised to share the experience among tutors within the plant departments and plants of EDF.

This extensive project has been incorporated gradually as the most important method of development and upkeep of pedagogical skills and systematic training of tutors, as well as trainers, shadow trainers, mentors, managers.

**Conclusion:** Satisfactory progress to date.

**2.1(a) Good practice:** Plant managers assess staff skills using a skills mapping tool.

Skill mapping involves using a table that helps work teams see clearly:

- individual skills categorised by type of activity
- overall collective skills, strengths and shortcomings, by comparing them to a set target value
- the likely evolution of individual skills over the coming years, focusing on each person's particular professional life-time plan (career development, retirement).

Analysis of this skills mapping allows managers to:

- better identify any specific skills needed
- anticipate the skills development action plans needed to ensure their teams' continuing ability to carry out their responsibilities.

Results achieved are:

- Analysis of the impact of retirement among I & C workers and adapting recruitment plans correspondingly (due to lengthy a training programme).
- Development of a plan for training electricians following a change in policy regarding the use of contractors.

This simple tool helps managers ensure their staff's skills match those required for operating the units.



## 2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

**2.2(1) Issue:** There is no clear plan or schedule for periodic review and timely modification and updating of the training facilities and material when necessary, to ensure that they reflect modifications and changes made at the plant.

Many mock-ups and replicas of actual equipment are at disposal of plant to provide specific training. As well a lot of aids are available to support classroom and practical training. However some of them are obviously not in conformity with plant originals (many videotapes are more than twenty years old), for others such information is not available at all.

The training organization has not established written document for reviewing and updating of training facilities and training material. The use of out of date training facilities and material is ineffective and does not ensure achievement of defined goals.

Without regulated configuration management of the training facilities and material, opportunities to improve the personnel competences to support safe operation of the plant could be restricted.

**Suggestion:** The plant should consider establishing and implementing a programme for periodic review and timely modification and updating of the training facilities and training material.

**Basis:** IAEA Ref A Guidebook Technical report series 380, item 6.3.6, Safety guide NS-G-2.8, item 4.15 d).

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

The plant has exhibited its expectations with regard to the monitoring and quality of training material management at Blayais NPP.

Following a meeting between the customer and contractor, the professional training department drew up procedure no. 6608/56/PCT NT, entitled “Management of training materials at Blayais NPP”, listing all the actions taken by the plant to maintain the quality of training materials used in training sessions provided by Blayais NPP. NB : With the exception of the full-scope simulator, these training materials are only used to facilitate the understanding of phenomena and the acquisition of problem-solving methods in response to failures or incidents. They are not used to training workers in the use of this equipment, which they will not encounter in the plant.

Only the full-scale simulator is used to train workers in operating skills. It is a replica of a 900-MW PWR unit (Gravelines unit 1).

### **IAEA Comments:**

Programme for periodic review and timely modification and updating of the training facilities and training material has been established. This programme has been included to document “Management of training materials at Blayais NPP” that lists all the actions taken by the plant to maintain the quality of training materials used in training sessions provided by Blayais NPP. This revised document has also clearly set out for each of the plant departments their responsibilities for related updating of the training facilities and training materials.

**Conclusion: Issue resolved.**

## 2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

**2.3(a) Good practice:** The plant develops specific simulator scenarios for assessment of safety engineer's competency and for improving coordination between I&C technical staff and operators.

This intervention of the plant is a part of the reactor scram reduction plan. Such practice has following strengths:

- Train participants in prevention of human performance related risks and operational communication.
- Make and apply risk assessments and carry out pre-job briefings of good quality by pooling I&C and operations skills on full-scope simulator.
- Improve quality of risk assessments and pre-job briefings.

This practice leads to increasing of effectiveness of simulator training and improving the competences of so called "sensitive" staff. The results achieved are:

- Human error reduction to prevent scrams.
- Reduction in significant operating event risk related to human performance.
- Better understanding of I & C and operations requirements and constraints.
- Systematic review of risks and countermeasures by maintenance and maintenance/operations participants during sensitive work (risk of scrams and load reduction).
- Training, observation and improvement concerning I & C and operations practices.
- Simulator training without incurring any risks related to nuclear safety and availability.
- Joint debriefing of I & C and operations staff, improving understanding of strengths and weaknesses in the areas of operational communication and craft-specific constraints.
- Investment of upper supervisory levels in evaluating the quality of joint I & C and operations pre-job briefings and participants' control room behaviour.

### 3. OPERATIONS

#### 3.1. ORGANIZATION AND FUNCTIONS

The operation department of Blayais NPP is managed and staffed by well-qualified engineers, professionals and technicians. The operations management and staff demonstrate clear understanding of structure, roles, and mission of the department. The operations expectations and standards are presented in goals and objectives that are measurable and manageable in number and performance indicators are established to improve performance. This is routinely tracked with the results clearly communicated to the operations group.

The organizational structure of the operating group including all on-shift and day off-shift personnel from the power operation structure is clearly defined, understood and working well. Within the power operation structure, the operations department assumes overall responsibility for plant operation, by coordination the various groups setting objectives and priorities with a view to making continuous progress in the areas of nuclear safety, industrial safety, radiation protection, plant availability, material condition and the environment.

The plant management and the operation manager are actively involved in the resolution of personnel problems and promote consciousness of safety as the primary focus. The managers and supervisors at all levels are deeply involved in discussion and resolution of technical and organizational problems. Good regular communication exists between senior operations management and control room operators. There is evidence that the safety culture is well understood and properly treated by the operation department management and the personnel.

The appropriate controls are established that minimize distractions to the shift personnel and enables the crew to remain alert during changing plant conditions. The off-shift organization is divided into four areas and their roles are to support the on-shift structure in the areas of expert appraisal and operator experience feedback, work permit planning management, coordination of surveillances test, updates operational procedures and documents, operation activities planning, coordination of short shut-downs, planning and coordination of refueling outages, of online activities and training management.

Each manager/supervisor recognizes that operations must lead site and keep site maintaining an operational focus. Six shift teams per twin-unit are responsible for real-time operation. Each shift team has 1 shift manager, 1 shift supervisor, 1 tagging supervisor, at least 4 control room operators and 6 field operators. On shift personnel are supported by the day staff. Good communication lines exist for supporting the on shift operation outside of normal daily working hours. The crew on shift is also supported by an effective system of responsible managers on call.

The operations department is responsible for work prioritization and has oversight responsibility for the planning and scheduling of work affecting safe plant operation. The assessment is based on thorough checks, traceability and management involvement. The electronic logbook is strongly used in real time by managers and supervisors to follow the activities in control room. This includes the work permit system. Procedures have been established and implemented that control the plant risk during power operation shutdown and outage conditions.

Operations management has an integral role in the operations training programme and it is monitored by line management. The skills development within the operations department indicates that personnel are well trained and proficient. The shift teams receive retraining (classroom and full scope simulator) as part of their regular shift schedules.

Operations management has implemented a comprehensive staffing and succession plan (GPEC) for all operations staff for the next 10 years. The staffing plan has factored in recent legislation that reduced the work week to 32 hours and incorporates considerations such as retirement, promotions and training requirements. The team considers this to be a good practice.

The team did note that, on occasions during the start of shift briefing, control room operators assigned to monitor their respective units were, on several occasions required to respond to alarms inside the “common area” briefing room located between the control rooms. These control room operators also spent periods of time with their backs to the control room area. The control room operators did respond to any alarm annunciations that did occur. However, the team encourages operations management to review practices that give the impression of an unmonitored control room, if only for brief periods of time.

Operations management has not communicated, or reinforced, operator expectations and procedures that would improve human performance (i.e. reduce human error) either in the control room or the field. The OSART team recognizes that operations management is very aware of this issue and of the need for improvement. There are plans to implement programmes designed to reduce human error later in 2005. The OSART team recommends improvement in this area. Operations management should communicate, and reinforce, operator expectations and procedures that will improve human performance (i.e. reduce human error) both in the control room and in the field.

### 3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

There are two identical twin-unit control rooms. Each unit has a main control room and emergency shutdown panel. The control rooms are well equipped, well located and use consoles that include mimics, annunciator alarm panels and plant computer screens (nuclear safety, parameter trending, mimic flowchart). An information system, developed using Lotus Notes, has been set up for sharing shift turnover logs from the from control room operators shift manager, and deputy shift manager, as well as useful information for the smooth running of the power operations structure (TEF) project. The team considers the use of the electronic information system to be a good practice.

The common area located between the control rooms is used to hold briefings and debriefs. It is equipped with a mimic panel common to both units as well as common alarms and fire detection panels. Blayais control rooms are equipped with a man/machine interface that has evolved since the plant has been in operation, in accordance with the various sets of modifications.

Line-ups and tag outs for work or for other reasons are well managed and controlled by the tagging supervisor with support from off-shift personnel called the Operations Engineering Support Structure (IAA). Plant operations work is supported by a number of modern information systems and process computers that allow operators to retrieve and trend important performance data.

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

The control room lighting, layout and furniture adequately support the operators. Access is well controlled and has a peaceful atmosphere and to limit the access on the main control room. Procedures and equipment for normal and emergency activities were accessible to the operating crew. Adequate control of procedures and available space are maintained to ensure good conditions for operations. Documents are updated by on-shift or off-shift operations staff.

The plant has not established a formal system to control the operational aids although a clear understanding of the proper way to use additional supportive materials for the operators was observed in the field. Efforts are being made to ensure that additional instructions and support documents are controlled and approved. The team recommends improvement in this area.

Work environment conditions in the main control room and shutdown panel are adequate to support the performance of the operators such as emergency ventilation, as well as lighting, noise and temperature. The consoles, mimics, annunciator alarm panels, recorders, indicators, plant computer screens, in the control room and in the field are clearly indicated and number of lit annunciators is minimized.

The plant labeling is being improved although observations revealed that equipment labeling is not consistent and of the same quality throughout the plant. The OSART team recommends improvement in this area.

### 3.3. OPERATING RULES AND PROCEDURES

The operating rules for the plant are defined by Technical Specifications. Operations procedures are developed based on the technical specification limits. The surveillance test programme is well planned and executed. Surveillance test data is input to an electronic database so that important plant parameters are available site-wide for review and analysis. Conditions that impact on Technical Specifications are clearly defined and tracked by operations staff at all levels. A white board in each control room is used to indicate such conditions.

Operating procedures are generally in good condition, clearly written, well understood and provide the necessary references. The team noted that the process for temporary procedure modifications is based on the use of a single form (handwritten) at the front of the procedure containing the required review and approval signatures, together with details of the temporary modification. Untraceable, unverified, handwritten mark-ups appear in the body of the procedure, without the need for evidence of review and approval. There are approximately 140 such temporary procedure modifications in effect, with no formal target or formal programme for workdown. The team could find no evidence of operating errors that were caused by temporary procedure modifications. However, operations is encouraged to introduce more rigour into the process for managing temporary procedure modifications.

The operating procedure backlog is tracked by FIMODO (an electronic database). The team noted that there is no formal process to ensure that procedure revision requests are reviewed by the appropriate system experts on a systematic basis prior to implementation, to ensure

that design basis is maintained. Instead, the process relies heavily on the knowledge of staff within the procedures group or the shift crews. The procedure backlog is approximately 2000 for the plant, including approximately 700 that are associated with modification planned for the upcoming unit 4 outage. There are no targets established for procedure backlogs, nor is there a formal programme for workdown. In the time available the team did not detect any operational challenges caused by the backlog. However, the team encourages operations to establish a programme that sets targets and workdown criteria for the operating procedure backlog.

Emergency procedures are event based. They are of a high standard, are clearly understood and are easily accessible. The operations department responsible for applying these procedures is knowledgeable and demonstrated firm commitment to the need for procedural adherence when executing emergency procedures. There was evidence of strong corporate support in areas of initial issue and subsequent approvals. Entry conditions for emergency procedures are based on specific alarms annunciations that are clearly designated as “DOS” alarms. Severe Accident (GIAG) procedures have also been developed and are available in the control room. Control room operators can easily locate all required procedures.

A rigorous administrative lockout process is in place to ensure that the status of safety-related plant alignments is known and is readily available to staff involved in work planning. A computer-based application clearly indicates if a valve is part of a safety alignment. Manual valves, whose position is not annunciated in the control room, are locked as part of this process. A periodic surveillance programme is in place to confirm that system alignments are maintained.

The team did note the use of white-out (blanco) on one line-up maneuver sheet together with a revision to the sheet that was untraceable (no signatures or evidence of verification). Although there is no evidence that errors have occurred as a result of this practice, the team encouraged Operations to introduce more rigour into the process for completing documentation use to change plant alignments.

The team also noted that the line up maneuver sheets only specify the sequence of valving operations by exception (if there is no special instruction included, then valves can be operated in any sequence). However, a review of a line-up maneuver sheet used to isolate a (high system pressure) pump for maintenance revealed that valving sequence was not specified. This could have led to isolation of the pump suction valve prior to isolation of the discharge valve, contrary to normal industry practice (concern is over pressurization of suction pipework, if the pump discharge check valve is passing). The team encourages the plant to introduce more rigour into the sequencing requirements when plant alignments are being changed.

### 3.4. CONDUCT OF OPERATIONS

The behaviour in the control rooms is very professional and permission is required prior to entry. Activities are well-controlled and executed, system and component status changes are appropriately authorized. Operations procedures are available in the control room and are generally kept in good condition. Operators in the control room were attentive at the control board to changing plant conditions.

Shift turnover was observed by the team. The oncoming operators received written and verbal input from the off going operators. A shift briefing for all oncoming shift members was conducted and lead by the deputy shift manager. The shift manager 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 ensure that 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.

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 criteria are clearly defined.

The safety engineer and shift manager conduct a review of any off normal events. The senior management of operations and the site provide oversight and review of the events and adequate management review prior to unit restart.

Fields operators do not always identify and report deviations from normal operating conditions and several deficiencies in the field have not been reported in a timely manner. The OSART team recognizes that improvements have been made in this area. However, further improvements are required. The OSART team recommends improvement in this area.

### 3.5. WORK AUTHORIZATION

The plant system for work authorization is well organized. Deficiencies are reported using SYGMA (a corporate network application). There are several daily multi-functional work control meetings, with managers involved that 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.

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 "Group 1/Group 2 Equipment out of service" board maintained in each control room.

The operations department has established an outage group consisting of an off shift manager and 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.

### 3.6. FIRE PREVENTION AND PROTECTION PROGRAMME

The plant effectively applies a structured fire protection programme. The team observed well maintained fire protection equipment and knowledgeable staff with well described and understood responsibilities in case of a fire. Fire fighting activities are conducted by the local civil fire brigade with logistical support from Blayais shift staff (second line response). Both are well equipped with the necessary fire fighting and protective equipment, well trained and frequently attending fire drills. Observation of these drills showed that they are conducted professionally and efficiently. All parties involved in the drill participated and provided critical feedback.

The plant arrangement for conducting the necessary action and their coordination was evaluated as adequate and efficient and 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 directly from the local alarm panel area. The second line response team deals with small fires and fire containment. The third team is the external fire-fighting brigade.

The Blayais NPP fire protection programme follows most international industrial practices and fire protection systems rely on a good fire alarm system. They enable Blayais NPP to ensure that reference standards are met (fire zoning, fire load management, risk assessment, etc.). To do this, all aspects of fire risk prevention defined in the safety reference documents are incorporated into the plant's fire-prevention organization and apply to work planning, work performance, plant maintenance, training of all staff and relationships with off-site response teams.

Adequate maintenance is performed and the fire protection equipment show excellent conditions as well as fire barriers satisfied the expectations. Each fire zoning item and area is identified, signposted in the field and entered into SYGMA (work management system) in order to monitor fire zone conditions. Loss-of-integrity criteria are defined and repair deadlines are set. If they are exceeded, the operations departments must report a safety-related event. Any planned or unplanned loss of integrity gives rise to a risk assessment, which is written up by operations and tracked in the 'loss of integrity' database (in Lotus Notes). If necessary, stopgap measures are set in place. The check carried out prior to criticality is incorporated into the outage schedule and constitutes a hold point at the start-up committee meeting (CDR).

Systematic control of combustible material is maintained. Whenever a permanent enclosed storage area is set up, the requesting party must request an installation impact study and submit it to the fire officer, who conducts the study together with the risk.

Plant surveillance programme for fire protection equipment is well structured and developed. Surveillance tests and checks performed on various items of operating and fire fighting equipment are carried out in accordance with policy documents or current rules and regulations.

The qualifications and experience are commensurate with responsibilities and there is a fire officer that maintains a good relationship between the NPP and local civil fire brigade. In order to ensure sufficient coverage around the clock, a partnership agreement between the



NPP and the SDIS provides for backup from the Blayais emergency response center of up to 14 professional fire fighters. The site has a set of well developed and detailed preplans supporting the use of offsite fire groups. Good and realistic initial and refresher training programmes are performed. Frequently the NPP personnel have specific training as well a team undergoes one partial drill every two months. Approximately 150 local civil fireman undergo training in Blayais NPP.

### 3.7. MANAGEMENT OF ACCIDENT CONDITIONS

Accident management is well organized and is considered to provide adequate response. Roles and responsibilities during emergencies are clearly defined within the operations department. Normal shift compliment ensures that the emergency plan can be effectively implemented.

The full-scope simulator is use effectively to expose control room staff to training scenarios that are challenging and realistic. Separate “technical” and “situational” scenarios are used to train and evaluate different competency areas. The simulator instructor provides effective “on the spot” feedback as required during the training scenario.

### **BLAYAIS NPP FOLLOW-UP SELF ASSESSMENT**

The OSART mission was a highlight for both operations departments because of the credit we were given for our good practices, as well as the depth and insight of the areas for improvement identified by the reviewers.

The operations departments have incorporated the four recommendations into their action plan and management contract, in order to make them powerful driving forces in bringing about improvements. We have addressed each of the recommendations individually and have appointed a project coordinator who is in charge of the project.

We have achieved real momentum in the development of error reduction tools and the improvement of human performance in order to continue raising our safety standards. We have raised our expectations regarding our ability to detect and report minor deficiencies in the field.

We have also focused our efforts on equipment labelling as well as on stringent management of operator aids in the field, by involving our staff wherever possible.

We have made these four recommendations a priority, convinced as we are that they will help us to raise our safety standards on a daily basis.

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

In the area of operations (OP), the team has concluded that Operation’s organizations have taken a broad look at issues identified during the OSART mission. The deviations were properly identified and appropriate actions have been taken to resolve one of four issues and significant progress has been made on other three items. The Operation departments and relevant persons are deeply involved and committed to improving the following areas: human performance in the MCR and in the field, labeling, operator aids and field operator rounds.

The operation departments have established a system for improving of human performance in the main control room and in the field, with support from both the corporate and the site level. The plant has enhanced human performance in those human error reduction areas, which include PJB, one-minute stop approach and debriefing. Other aspects of human performance are covered by long-term plans.

The plant has reinforced the system for the continual improvement of labeling. Good progress has been achieved in the implementation of labeling for big items of equipment. But there is still room to improve the quality of labeling, as seen through ongoing long term plans for further improvement.

The operation organization has successfully improved the process regarding to the use of operator aids, including an organization and continual checking system. Good progress in the implementation of operator aids in the MCR and in the field has been achieved. The project is going to be finished by the end of 2006, as scheduled.

The plant has reinforced the system for continual improvement of identification and reporting of low-level deficiencies in the field. Specific working groups for operator rounds have been established to solve discrepancies. But there is still room to improve the quality of field operators rounds, as seen through deficiencies identified by the team during walk downs like leaks, missing failure identification cards, industrial safety risk, boron buildups etc.

## DETAILED OPERATIONS FINDINGS

### 3.1. ORGANIZATIONS AND FUNCTIONS

**3.1(1) Issue:** Operations management has not effectively communicated, or reinforced, operator expectations and procedures that would improve human performance (i.e. reduce human error) either in the control room or the field.

The OSART team recognizes that the plant is well aware of the needs, and has already made some progress in this area. However, further improvements should be made in order to meet international standards. The team observed following facts:

- No generic control room alarm response procedure is in use on a consistent basis by control room staff that addresses unit overall stability and the use of error reduction tools such as overt self-check, peer checking and three-way communication. Alarm response procedures are available that address the technical aspects of the parameter(s) that initiated the alarm annunciation(s), the automatic actions (if any) and the operator actions required to stabilize the unit. Control room operators were observed to be rigorous in their response to control room alarms as dictated by existing procedures. However, when responding to alarms at no time was it observed that overall unit stability checks were completed (i.e. confirmation of reactor power control, intact primary coolant, and intact confinement).
- The use of error reduction tools, such as self-check, was inconsistently applied by the control room operator during the completion of a surveillance test on unit 4 that involved the manipulation of panel hand switches that controlled two (safety-related) emergency air compressors and an associated motorized valve. Furthermore, no peer checks were requested, even though additional control room staff was available to perform this function.
- No generic procedures are in use on a consistent basis by field operators for the execution of either electronic rounds or observation rounds. Field operators completing rounds (both electronic and observation) were observed to have no procedure in hand for rounds completion that would specify the specific areas to be checked, and the expectations for rigour in executing rounds.
- No generic procedures are in use on a consistent basis by field operators for the execution of equipment manipulations in the field (e.g. valve opening or closure). A field operator completing a surveillance test that required the manipulation of four valves that would impact directly on hydrogen pressure in the unit 4 generator did not have a procedure in hand (subsequent discussions with operations management revealed that there is no procedure for this specific evolution, only a valve alignment for normal operation). Furthermore, the field operator did not use error prevention tools such as self check when operating manual valves that could be confused with other valves, in close proximity, and with similar equipment identifications i.e. 4 GRV 011 VY, 4 GRV 001 VY, 4 GRV 010 VY, and 4 GRV 101 VY.
- There is no evidence that operations management (including shift crew supervision) has been trained to observe, and provide feedback on, control room operator, and field operator activities, from a human performance perspective. For

example, one shift manager, when asked to describe what would be looked for in terms of behaviours for when accompanying a field operator during task execution in the field, talked about technical issues (e.g. confirm correct procedure being completed correctly) and industrial safety (e.g. correct personal protective equipment). The shift manager did mention the requirement for a questioning attitude (without describing what this “looks like”). These are very important factors that must be considered. However, there was no mention of the use of error prevention tools such as self-check. A supervisor looking for evidence of Self Check would expect to observe positive confirmation of correct unit (by an overt comparison between procedure and building/area designation) and correct equipment to be operated (by an overt comparison between procedure and equipment label), followed by an observable pause prior to operating the equipment, in order to review expected equipment response. Before the operator makes positive contact with the equipment (e.g. handswitch), the supervisor could ask the operator about what indications/responses would be expected following the operation. Examples of expected responses would include specific lamp indications and/or gauge responses.

- In October 2003, a field operator, in error, racked out the 6.6 KV circuit breaker to a Containment Spray Pump (4 EAS 001 PO – a safety-related device). The intention was to rack out the adjacent circuit breaker to an Essential Service Water pump (4 SEC 003 PO). The operator, on discovering the error, racked the circuit breaker back in within a few minutes and then self-reported the event to the control room operator and the shift manager. The follow up that ensued focused on the safety significance of the event and the appropriateness of the notifications that had been completed. However, there is no evidence that the event was analyzed from a human performance perspective. i.e. what could be done to prevent a “repeat” human error? In discussions about sequencing of the job tasks associated with opening a circuit breaker, it became apparent the sequence of tasks that was employed in this specific case may have contributed to a break in eye contact with the correct circuit breaker and the subsequent operation of the adjacent breaker. An appropriate human factors analysis would likely have determined this. This would have given operations management the opportunity to communicate and reinforce expectations about operator self-check practices.

Unless appropriate expectations with respect to human performance for control room and field operators are communicated and reinforced on a regular basis, then operators will continue to complete tasks without the consistent application of tools to ensure event free operation. The consequence of this is that safety-significant events due to human error, leading to degradation in plant safety, could occur with an undesirable frequency.

**Recommendation:** Operations management should communicate, and reinforce, operator expectations and procedures that will improve human performance (i.e. reduce human error) both in the control room and in the field.

**Basis:** IAEA Safety Standard Series NS-G-2.4 section 6.2.

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

Adherence to expectations and implementation of the human performance programme are priorities of both operations departments in their efforts to improve performance in the areas of operational safety, industrial safety and radiation protection.

Progress actions are driven by the DPN human performance project, which is being rolled out at Blayais NPP. The human performance project started being implemented on the site in May 2006 and will be completed by the end of 2008, particularly in the operations departments. The project incorporates actions already carried out for activities with a potential reactor scram risk (including pre-job briefings), which have helped to reduce the number of reactor scrams by a factor of 3 since 2003.

#### The purpose of this project is to :

- A. Increase management presence in the field with the specific aim of clarifying and reiterating expectations and monitoring their implementation in the field and control room,
- B. Implement a human error reduction programme in the control room or in the field.

#### Results achieved in above mentioned projects :

##### A. Management presence in the field to reinforce adherence to expectations

Management presence in the field has increased significantly within the operations departments. Momentum is being sustained and can be viewed in the electronic database. Management presence in the field is clearly exhibited and is being rolled out at senior management and team level.

Current actions falling within the scope of the human performance project :

- Streamlining of the site's meeting system in order free up time for managers to spend time in the field,
- Defining management presence expectations for each management level,
- Improving analysis and use of information coming from the field,
- Training and coaching managers,
- Making it easier to keep a record of management presence in the field.

##### B. Implementation of error reduction tools :

This programme is currently being rolled out. To begin with, training is provided to operations department senior management teams before the end of 2006. It is then up to managers to train their teams, with the aim of training all operations staff by the end of 2007.

The following error reduction tools are being used :

- Pre-job briefings,
- One-minute pause :
  - 1 minute pause before starting,
  - 1 minute pause in the event of interruption,
  - 1 minute pause in the event of an unexpected occurrence,
  - 1 minute pause in the event of timing problems.
- Self-checking,

- Peer checking,
- Three-way communication,
- Debriefings.

Practices associated with pre-job briefings, the 1-minute pause and debriefings will be formally stipulated for all activities falling within the scope of this programme and will be our priority for 2007. Other practices will be implemented depending on context or on expectations.

Project milestones and expected results :

- First activities to be performed by operations staff using error reduction tools by 31 December 2006, with associated management observations (management observation plan for both operations departments),
- All operations staff will be trained in these practices by the end of 2007, at the same time as they are being implemented,
- Error reduction tools will be implemented for all activities comprising an element of risk by the end of 2008. Management will carry out checks to ascertain that these expectations are being met.

**IAEA Comments:**

System for improvement of human performance is established at both the corporate level and the site level but it is not fully implemented. Cascade training on human error reduction techniques with focus on PJB, one minute stop approach and debriefing, for managers, HP counterparts and staff has been set up, scheduled and done for some of them up to date. Further training on human performance, including other aspects of human error reduction techniques, is planned with a deadline by the end of 2008, including updated simulator training on this matter. Long term activities have been scheduled, objectives and success criteria defined. Affected processes and relations, departments and project managers have been identified and appointed. Rules and procedures are elaborated and some have been applied.

The plant has improved human performance in the main control room and in the field, but some aspects of this recommendation have not been fulfilled because of lack of time, however these items are covered by long-term plans.

**Conclusion:** Satisfactory progress to date.

**3.1(a) Good practice:** Operations management has implemented a comprehensive staffing and succession plan (GPEC) for all operations staff for the next 10 years. The staffing plan has factored in recent company policy that reduced the work week to 32 hours and incorporates considerations such as retirement, promotions and training requirements. The team considers that this is a good practice.

- Known departures (retirement) and foreseeable departures (change of position including promotions) factored in.
- Intake needs are defined on the basis of unfilled positions.

- Training periods prior to filling the position are factored in.
- Hiring dates (internal or external) are defined and positions are advertised.
- Department management is responsible for adapting actual qualified manpower to department needs.
- A specific GPEC management meeting, chaired by plant senior management, is held twice a year in order to review possible job changes for managers in operations, safety/quality engineering and training departments.
- A user-friendly tool (Excel application) is used effectively.

### 3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

**3.2(1) Issue:** The Blayais plant equipment labeling system is not well maintained. Operations management recognizes this and considerable effort has already been made to improve. However, there is safety-related, and other, equipment that is not labeled appropriately.

The team observed the following:

- Unit 2 Turbine Building – 0 meter elevation, next to the Blow Off Relief Tank: marker pen on two instruments: Tag’s 2STR 14 ST and 2STR 13 LT.
- Unit 2 Room 267- Rod Cluster Control Assembly Motor Generators 1 and 2: broken equipment labels (some words missing).
- Unit 2 Room W269- Labeling is not clear at either safety-related Auxiliary Feed Water Motor Pumps (2 ASG 011 and 2 ASG 012). The individual valves associated with these pumps are labeled.
- Unit 2 room W271-Auxiliary Feed Water Turbine Pump: marker pen on two instruments: Tags 2ASG 031 SP ASG and 2ASG 501 EP.
- Unit 2 Diesel Generator A (2LHP) – marker in the key 108CC at the Panel of local Control Room.
- Unit 2 room L241- Instrument Air Station: marker pen on several panels: Tags DVG 004CR2 (Key 018 LA), DVG 003CR2 (Keys 017 LA and 021 LA), 2 SAP 001 AR and 2 SAP 002 AR.
- Unit 1 Turbine Building: Marker pen on panels 1DNMT 16PJ, 1GRH001 AR (keys and status light), 1GRV052CR (keys 01CC, 02CC and 03CC); pumps 1GGR001PO, 1GGR002PO.
- Unit 1 Turbine Building: labeling is not appropriate (small labels are too small at large equipment) e.g. Air Compressor SAP3CO and Water Condenser Pumps 1CEX001/002/003 PO.
- Inappropriate labeling (handwritten on tape): 3REA228VP (CVS room) and 3DTVK24CR.
- Broken label: Tr156UB at room W213 and missing labels on 4CFI002PO and 4CFI042PO.
- Unit 1-Handwritten maker pen on tape: Pick-up AGR001 MV of Main Feed water Pumps 1APP001.
- Unit 1- Missing equipment identification label at valve 1ABP142 VL, and on oil temperature detector FWP 4APP 002PO.
- Some redundant equipment was identical in appearance, located in close proximity to, and labeled with almost identical equipment ID’s (concern: potential for “wrong equipment” events, no self-check reminders evident). Same issue with valves in close proximity:
  - Adjacent Feed water pumps: 2 ASG- 011- F1 and 2 ASG-012-F1
  - Adjacent Valves: 4 GRV 001 VY and 4 GRV 011 VY



- Adjacent Valves: 4 GRV 101 VY and 4 GRV 010 VY
- On many instances, unit designations were not clearly marked and there was no systematic method (of e.g. colour coding, or self-check reminders) in place to minimize the possibility of a “wrong unit” event:
  - The exits from the “Unit 8” Common services control room into the Unit 3 and Unit 4 control room are not labeled to indicate what control rooms are being accessed.
  - The units 3 and 4 main turbine floor (15.5 m level) has no clear unit identifiers (except for the small labels on specific pieces of equipment). In contrast, the 0m level for units 3 and 4, has large “Unit 3” and “Unit 4” colour-coded squares painted on the floor, at the entrances to, and throughout each area.

Unless all equipment in the plant is labeled appropriately, there is increased potential for “wrong equipment” events. Such events could occur as a result of either “wrong equipment-correct unit” or “wrong unit” activities, with the increased potential for a degradation of plant safety.

**Recommendation:** The plant should reinforce expectations for systematic maintenance of equipment labeling.

**Basis:** IAEA Safety Standard 50-SG-Q13 para 342.

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

The first action taken by the site to address this recommendation was to start addressing deficiencies identified in the OSART report, such as that pertaining to inappropriate labelling (small label sizes inappropriate for large equipment”). The operations departments have obtained printers in order to produce labels. Large labels have now been affixed to more than 200 large items of equipment. This phase was carried out by workers taken off shift from each team, in order to standardise the way in which labels were affixed to these large items of equipment.

A procedure (D5150NTC000600) dealing with the replacement of defective labels has been in use since May 2005. The operations departments have been responsible for producing and affixing labels since 2005.

Surveillance tests (DIV EQ) have been drawn up in order to monitor plant condition on a regular basis (every 16 weeks), with each team being in charge of given area. These surveillance tests require that labelling condition be checked :

- No missing labels on equipment
- Labels compliant with mechanical drawings
- Temporary labels removed

Management field inspections also take into account labelling quality and observed deficiencies are recorded in the site’s “management presence” database. Reports are sent to the operations departments for the replacement or repair of missing or damaged labels.

Operations staff seconded to the fix-it-now team in charge performing tool-pouch jobs deal with labelling deficiencies reported by maintenance (about twenty per month).

Labelling is being brought up to standard using an established process which is coordinated and monitored via management field inspections.

The budget set aside for the production of labels is estimated at 11K€ per twin-unit group.

As regards the OSART team's finding on the need to improve unit signage in order to avoid unit confusion, specific floor markings have been laid out on all units. A barrier system has also been installed around electrical buses, making workers aware that they are entering areas of a unit in operation.

### **IAEA Comments:**

The plant has reinforced the system for continual improvement of labeling on the basis of a project at site level by defining plant expectations and objectives. Affected departments, working groups and individuals have been identified and appointed to be "owners" of operational areas. Training on observation for managers and staff has been set up; management plant tours are performed and recorded. Moreover, cross functional groups of fix-it-now teams have been established to solve discrepancies. Rules and procedures for identification and reporting of discrepancies are elaborated and have been applied. All necessary hardware measures are in place.

The plant has achieved good progress in the implementation of labeling for big items of equipment but still there is room to improve the quality of labeling, as seen through ongoing long term plans for further improvement.

**Conclusion:** Satisfactory progress to date.

**3.2(2) Issue:** There is no formal process in place that regulates the use of operator aids, and as a result they are not well controlled, either in the field or in the control room. Procedures defining the control of operator aids are currently in draft form. There is no procedure currently in place that states expectations regarding control of operator field aids:

The team observed the following facts:

- In the Units 1&2 Essential Water Valves Room there was an uncontrolled system drawing on the wall.
- In the Unit 1 control room, on May 06, 2005, there were two untraceable hand written cards:
  - One card at the AP 002 Main Feed Water Pump handswitch. The card referenced Technical Instruction IT 711 (to maintain a specific feed water flow). A review of the computer database revealed that Technical Instruction IT 711 had expired on April 07 2005 and that associated Work Permit DI 550575 had expired on March 31 2005.
  - One card at the Vacuum Pump handswitch, dated Feb 14, 2005, indicating that there was a vibration issue with the pump. Control room staff were unable to provide an update of pump status or the associated work request (DI583088).
- In the Unit 3 control room, on May 9, 2005, there were untraceable cards:

- Handwritten-at the hand switch for vacuum pump 3CGR 004PO indicating that the pump was not to be placed in service because of minor leakage.
  - Printed-at the hand switches for the following valves: 3RIS 001VP, 3RIS 002VP, 3RIS 003VP, 3EAS 007VB, 3EAS 008VB, 3EAS 009 VB and 3EAS 010VB, indicating that there was a problem related to frequent operation.
  - In the Unit 4 control room, on May 9, 2005, there were untraceable printed cards:
  - At the hand switches for valves 4RRI 005 TL and 4RRI 007 TL referring to related Operational Experience.
- In the Unit 2 Restricted Control Area (RCA):
- Uncontrolled system drawing on the panel of radiological waste treatment control room.
  - Handwritten instruction (marker pen) on the panel of radiological waste treatment control room, near 9 TES 002 RS indicating the required temperature range to maintain under specific conditions, in accordance with a temporary instruction.
- In the Unit 4 Diesel Generator control room: Uncontrolled drawings on the panels (4LHP 001 and LHQ 001)

Without rigorous control of the information that is available to operations staff as they execute their duties in the control room, and in the field, there is the increased potential for errors caused by operational decisions and actions based on incorrect information. This could lead to a degradation of plant safety.

**Recommendation:** The plant should implement a formal process to ensure rigour in the control of all operator aids, both in the control rooms and in the field.

**Basis:** IAEA Safety Guide No. NS-G-2.4 para 6.61.

**Plant response/action:**

Given the importance of this issue, a coordinator was appointed in the summer of 2005.

In order to develop this project, a representative from each craft was appointed to make an exhaustive inventory of necessary operations-related information displayed inside the industrial areas. This inventory of all operator aids has completed and is being used to supplement the procedure which sets out expectations.

Guideline ref. D.5150.GUI.C12.0002. This document has been approved by the operational safety committee (COS).

The project associated with this recommendation is built around an action plan :

- Inventory and standardisation of signposting practices,
- Writing and approval of reference standards,
- Bringing displayed information into line with expectations (in progress, to be closed out by the end of 2006).

**IAEA Comments:**

The organization and system for improving the usage of operator aids is established and formalized. The plant has harmonized the standard layouts and formats of operator aids for all 4 units within affected departments, areas and rooms. Rules are defined and procedures for implementation and checking are elaborated. Good progress in the implementation of operator aids in the MCR and in the field has been achieved. The project is going to be finished by the end of 2006.

The plant has successfully improved the process regarding to the use of operator aids including organization and continual checking system.

**Conclusion:** Issue resolved.

**3.2(a) Good practice:** Widespread use of electronic information systems that disseminate plant information site-wide in a timely manner. Examples:

- Shift manager, deputy shift manager & control room operator logs (field operator logs currently completed using pen & paper, but plans are underway to convert these to an electronic application)
- Minutes of operations planning meetings
- Plant trend data from the results of surveillance tests.
- Electronic data collection by field operators completing rounds. Data from plant equipment is input to a handheld electronic module during the rounds and then downloaded each shift to a PC-based network application, accessible by staff plant-wide.

### 3.4. CONDUCT OF OPERATIONS

**3.4(1) Issue:** Effective communication of expectations do not always ensure that field operators identify and report all deficiencies in the field.

The OSART team recognizes that plant management is aware of this issue, and that, as a result of recent plant initiatives, improvements have been made. However, there is still widespread evidence throughout the plant that deficiencies in the field are not being identified and reported by field operators:

The following are examples of deficiencies noted by members of the OSART team, and not previously reported (i.e. no work requests filed):

- In the Unit 1 Turbine Building:
  - Oil leak at pump 1GGR001PO.
  - Light bulbs burned out at panels 1GGR002TB (6 light bulbs), 1GRV052CR (1 light bulb) and SAP3CO (6 light bulbs).
  - Defective seal water outlet flow meters associated with Water Condenser Pump (1CEX001/002/003 PO) and Main Feed water Pumps (1APP001 PO and 1APP002 PO).
  - Pipe supports missing, resulting in excessive vibration of a hydraulic pipe beside valve 1SIT031 VL.
- In the Unit 3 electrical room TAPLEAN 8LNF:
  - Many tags were not legible.
  - Two gas bottles (behind the door 3 JSN 231QG), one of which was not properly fixed.
- Unit 2 RCA-
  - Boron residue on the floor near valve 2RCV 063VP.
  - In Room W255: 3 gas bottles (Oxygen, Argon and Acetylene) improperly stored.
  - Cable drum near valve W 2JPI 098VE impeding operation of the valve.
  - Improper storage of equipment: Metallic box, bookcase, glass bottle improperly storage so as to impede operation of valves 2RCV 042VP, 2RCV 043VP, 2RCV 044VP (associated with the Charging Pumps).
  - Valve 2RIS 610 VP had no lock, however the attached Operation tag specified “Close and lock”.
  - In Room 383: A large equipment cart was not locked so as to prevent movement.
  - Alarm annunciation windows/lights lit and equipment identification inadequate. Field operator cannot offer an explanation: 2 RRB 207AR (2 bulbs), 2 RRB 107AR (1 bulb) and 2 RRB 105AR (2 bulbs).

- In the Unit 4 Emergency Air Compressor room: The field operator on rounds, prior to the start of a surveillance test (Emergency Air Compressor Test) did not verify important parameters such as oil level (operator could not immediately locate the oil level indicator).
- A padlock observed without any label, valve 4EAS 134VB.
- Lighting: burned out light bulb inside the Connection Essential Water Valves Room (safety related equipment, SEC system), Units 1&2. The lighting inside is in bad condition.
- Scaffolding since 06/April/2005 blockading the eye wash first aid, beside Hydraulic Control System Package 1GFR, Unit.
- Housekeeping: Several materials (trash) close 4 PTR 05 PO. Lead shielding and hose, plastic and water on the floor at level -3,00m near the pumps 2 CEX 001/002 AP.

Unless field operators, who are the “eyes and ears” of the operations department, report all field deficiencies, including low level deficiencies, in a timely manner so that equipment repairs can be initiated, plant material condition will deteriorate, with a corresponding potential for degradation of plant safety.

**Recommendation:** The plant should ensure effective communication of expectations of field operators and continue to reinforce improvements for reporting field deficiencies in order to ensure that high standards of plant material conditions are implemented.

**Basis:** IAEA Safety Standard NS-R-2 para 2.3(4) and best international practice.

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

Plant condition standards form an essential part of the work performed by field operators. They are a vital component in the upkeep of plant conditions. For this reason, each field operator must be aware of the expected standard.

In order to meet this expectation, the following actions have been implemented :

- Each shift team has been assigned geographical “owner” areas. Six areas have been defined for each twin-unit group,
- Within the team’s geographical area, each field operator has been assigned certain rooms. This action is currently being rolled out within each shift team,
- A “housekeeping” surveillance test is performed for each geographical area. This test is assigned to the team in charge. It is performed at sixteen-week intervals and is tracked electronically (PRV module). Results of this test are entered into the Lotus Notes “management presence” database,
- Development of specific training for field operators, consisting of :
  - Expectations pertaining to plant and material condition (“plant and material condition” guidelines),
  - System used to issue work requests and tool-pouch job requests,

- System in place for maintenance to deal with deficiencies.
- Field operators scheduled to be seconded to the the fix-it-now team for a few months at a time,
- Cardboard tags affixed to deficiencies in the field, for which a work request or tool-pouch job request has been issued.

In order to improve the tracking of improvements in the detection of deficiencies by field operators, we have stepped up management presence in the field and provided the necessary coaching. In 2006, our field inspection schedule has been adjusted to have team managers spending more time in the field (shift managers, deputy shift managers). Managers conduct one visit per shift week, which is incorporated into the shift manager's observation plan. Inspections must be recorded in the "management presence" database. During these inspections, the shift manager or deputy shift manager observes the way in which workers fulfil their role of upholding "plant material and condition" reference standards.

A further monitoring process involving members of the extended senior management committee has been implemented in 2006 to bolster the existing system.

A set of plant monitoring reference standards intended for use by shift operations teams has been drawn up by two shift managers, on the basis of DPN reference standards.

This set of reference standards has been formally approved by senior management of both operations department and been converted into a site governing procedure which is common to all shift teams.

In addition, the "operator round" working group comprising field operators and coordinated by a deputy shift manager is in the process of drawing up a guide for the performance of operator rounds, which includes expectations relating to the detection of deficiencies.

#### **IAEA Comments:**

The plant has reinforced the system for continual improvement of identification and reporting of low-level deficiencies in the field by defining plant expectations and objectives. Affected departments, working groups and individuals have been identified and appointed to be "owners" of operational areas. Self-training on observation and surveillance techniques for all operations shift team members has been set up, scheduled and some groups have been trained up to date. Further training is planned with a deadline by the end of March 2007. Moreover, cross functional groups of fix-it-now teams and specific working groups for operator rounds have been established to solve discrepancies. Rules and procedures for discrepancies identification and reporting are elaborated and some of them have been applied. All necessary hardware measures are in place.

The plant has still room to improve quality of field operators rounds, as seen through deficiencies identified by the team during walk downs like leaks, missing failure identification cards, industrial safety risk, boron buildups etc.

**Conclusion:** Satisfactory Progress to Date.

## 4. MAINTENANCE

### 4.1. ORGANIZATION AND FUNCTIONS

The plant has established policies regarding different areas of performance including nuclear safety. All maintenance activities are performed on the basis of policies issued by the plant in accordance with national policies. The system for evaluating and revising policy documents, objectives and goals is effective, with respect to feedback results of nuclear fleet.

In order to support policies, plant strategic objectives have been established for the next three years. These objectives were used to develop maintenance department goals and objectives of processes valid for maintenance, as a part of their yearly contracts. Policies and performance indicators have been introduced to plant staff and are properly advertised through meetings, boards and plant newspapers.

Since March 2005, the new organizational structure has been implemented. The structure is process-based and the maintenance has been changed to the matrix organization. Maintenance departments are effectively conducted according to processes, depending on the operational status of units. Each department has defined rules, duties, responsibilities and authorities.

To be in line with the plant policies, there is a strong commitment to safety culture in maintenance. The safety-oriented approach can be noticed in staff's performance.

The system organizing the relationship with corporate organizations and among different plants and departments is clearly defined and working well. All discrepancies are solved accordingly.

Ongoing process for establishment of long-term contracts is in force to ensure the quality of contractors. The policy of contractor management is periodically reviewed and is part of the plant standards. The same system of qualification of contractors by corporate organizations is exhaustively implemented, contractor standards are equivalent to those of plant staff. A new system of supervision of contractors has been established to ensure quality of maintenance activities performed by contractors. The team noted this as a good practice.

On the basis of an efficient competences mapping system, management of replacement of retired personnel is carried out. The same system is properly used for permanent evaluation of qualification of personnel and this assessment is a basis for future training requirements.

### 4.2. MAINTENANCE FACILITIES AND EQUIPMENT

Maintenance facilities are adequate, well equipped and properly maintained, thus being able to ensure execution of maintenance by the plant staff. Arrangement of facilities promotes safe and efficient completion of work. Training facilities and mockups are used to improve skills prior to performing complicated jobs and to verify effectiveness of ALARA programmes.

To ensure availability and quality of tools and consumable supplies, the plant runs tool-rooms in clean or restricted control area. The tool-rooms are professionally conducted, approach to prevent usage of unserviceable equipment or equipment with expired validation is evident.

Lifting equipment is simply marked with the aim of simplifying identification of checked equipment. The team considers a solution being a good performance. Measurement devices



are properly calibrated, controlled, stored and tracked. To adjust torque wrenches for accurate works, a special adjustment tool is used. Decontamination facilities and remote controlled tools are effectively used in order to minimize radiation doses.

A policy designed to mark all chemicals and flammable materials is established to prevent the usage of chemicals with unacceptable content of chloride and to control the risk fire. The amount of flammable materials is permanently reviewed, but storage limits are not announced. The team encourages the plant to improve this area.

#### 4.3. MAINTENANCE PROGRAMMES

Preventive, corrective and conditional oriented maintenance programmes are used, for each facet of the programmes, procedures are prepared or the system of preparation is well implemented.

Preventive maintenance programmes are either elaborated under the guidance of nuclear fleet, or elaborated on the plant. Programmes are properly created in compliance with requests coming from recommendations of manufacturers, legislation and law, regulatory authorities and local and national feedback systems. All documents are evaluated and revised at least prior to works. Recommendations towards either national or local relevant departments are applied.

If equipment deviations are detected, efficient diagnostic evaluation follows it up and the results are used as a basis for following work request. All maintenance preventive programmes are developed in consideration of predictive maintenance techniques. They are evaluated at the national level to be in line with current industry good practices.

To improve performance in the area of nuclear safety, radiation protection, industrial safety, plant availability and environmental protection, the plant has established and permanently develops a risk assessment methodology as a project. This approach the team noticed as a good practice.

In the area of in-service inspections (ISI), the legal requirements and the maintenance programmes are the two requirements to be followed. Moreover, in order to achieve this objective, there is an indicator that no deviation from standards is allowed.

The plant ISI programmes have been properly established in compliance with regulatory and plant policy as well as with technical specifications. ISI programmes also support solving questions of erosion and corrosion in secondary circuits. Methods for inspections have been qualified in accordance with international standards.

While performing inspections, management of contractors is well ensured by qualified plant staff with the support of corporate group. Jobs are performed along with plant procedures, qualification requests are followed, equipment and crew are supplemented by contractors.

The system to solve detected deviations is developed and in force. Deviations are properly described, specified, evaluated, trended and tracked, their solution is a matter of authorization. ISI programmes, in accordance with updated maintenance history and coherent analysis of frequency or extent of inspections, are evaluated and updated after management approval.

Corrective maintenance is carried out with the support of SYGMA software. The system for defect identification is effective. Each work request is a subject to approval by hierarchy supervisor and other involved departments.

Effectiveness of corrective maintenance programme is periodically reviewed by weekly reports and improvements are made as appropriate.

The lifetime management on the plant is effectively conducted from national level as common projects of nuclear fleet. Within these projects, relevant degradation processes and sensitive components have been identified. DAPE software is used as a tool for an evaluation and re-qualification of components or systems.

#### 4.4. PROCEDURES, RECORDS AND HISTORIES

Management of preparation, usage and evaluation of procedures has been properly implemented. Assessment of procedures is obligatory to be performed prior to the job execution and the history first level analyses is performed just after the execution of job. Procedures are available for relevant staff either in hard copy or electronic form.

Acceptance criteria valid for current procedure are applied on the basis of design, manufacturer's recommendations or legal requirements. Procedures are adequately clear, concise, and contain adequate information in order to ensure quality of maintenance activities.

The maintenance history is conducted and maintained according to quality documentation and supported by software. The history documents are stored in archives and electronically. A content of history files is precisely described and evaluated in compliance with the plant needs. The software support allows the history to be easily retrievable and properly secured.

The history is permanently used to perform analysis, safety performance trends and causes of problems in order to identify root causes of problems and results are ordinary used to improve maintenance.

#### 4.5. CONDUCT OF MAINTENANCE WORK

Responsibilities related to conduct of maintenance are appropriately dedicated to maintenance and logistic departments. They act according to projects of outages and operation of units, managed by project managers.

The procedure regarding work performance is properly established. First line supervisors conduct maintenance field work competently and professionally, industrial and personal safety standards are taken into account. There is a requirement for presence of maintenance procedures with all relevant documents on job sites.

Dose reduction, as one of the main principles of the plant performance, is permanently used and ALARA approach is an important means of how to achieve the target.

Foreign material exclusion (FME) programme is developed, implemented, controlled and followed in the field. There are the FME procedure for pools, steam generators and reactor vessels and main features of behavior are defined. But the team noticed some discrepancies from industrial standards and has recommended an improvement in this area.

In order to ensure safety and availability of the plant, the following means are effectively used to achieve the plant objectives:

- Maintenance software support SYGMA
- Risk analysis assessment of maintenance activities.
- Two-level evaluation and approval of safety and priority.
- Usage of “Orange Procedures” for specific reactor trip risk, requiring actions including training and pre job briefing, the team noticed this as good performance.
- The programme of controls and reports for managers.
- Foremen and supervisors presence in the field at least twice a day.

The plant established an efficient system for re-qualification of equipment within both processes, during operation of units and outages. Supervisors manage re-qualifications and each work file includes a re-qualification sheet with approval of involved staff.

#### 4.6. MATERIAL CONDITIONS

Material conditions standards have been presented as expectations of management published in “Memento” and announced to the staff and contractors through meetings and contracts. However there are significant deviations in good working order of systems and equipment.

The team noticed discrepancies in material conditions during the plant tour and following observations. These findings are not in line with management expectations announced to the plant staff. In order to improve the plant performance, the team has made a suggestion in this area.

Maintenance department has created a system of walk downs for different positions within their structure and focused on different areas. Walk downs are properly planned and periodically evaluated and reported through intranet. For evaluation of relevant areas, different evaluation sheets are used, but there is not enough training in methods of observation.

#### 4.7. WORK CONTROL

The process of work control is based on planning and scheduling, work meetings and software support. All relevant information is available for the staff on intranet. Documents defining main features and consequences among operational and outage projects are properly placed.

In terms of planning and scheduling, preparation starts two weeks before current week and the schedule is prepared for the eight following days. The scope of work to be implemented and its level of preparation are properly evaluated prior to the job execution. The daily schedule is submitted for approval. An outage planning is a matter of work control of outage projects.

Prioritization of work is effectively analyzed daily following two steps. To be in accordance with safe operational conditions, all material and manpower requirements are adequately

considered. Weekly meetings for W-1 and W-2 weeks allow preparation of relevant jobs for the next two weeks.

To ensure nuclear safety and security during operation and shutdown, a risk assessment is systematically taken into account. Prior to each safety related job, risk analysis of work windows and coherent conditions is reassessed. Also risk assessment of work conditions is ordinary performed and results are applied to the elaboration of Risk Prevention Sheet. The team considers this approach as a good performance. Corrective actions can be applied in case of deviation from expectations.

One of the most important parts of maintenance performance in the plant is post maintenance analysis. Analysis results are properly included into the maintenance work files history and a system of approval of quality of maintenance work files prior to performance of jobs is used and tracked. This helps to improve maintenance effectiveness.

#### 4.8. SPARE PARTS AND MATERIALS

According to nuclear fleet policy responsibility for procurement is split between corporate and plant levels. Safety related spare parts are purchased by UTO on the basis of the plant requests. Commercial spare parts, except category C3I, are ensured by sites, depending on facet of spare parts. For category C3I UTO approval of supplier is necessary.

Responsibility for procurement and receipt inspection is precisely described and well understood. The effective system of control of receipt of spare parts is identical for safety related and commercial grade parts. Solution of deviations is formalized and tracked. Nonconforming parts are marked and stored separately to prevent their usage.

The plant owns and operates warehouses in conformity with consumption of process needs. They are in good conditions and well maintained. Conditions for environmentally sensitive parts are created, maintained and recorded.

All safety related spare parts are separately stored and these materials are traceable from supply to installation, but different kinds of spare parts, e.g. expired, broken or under re-qualification, are not separated from proper ones. The team encourages the plant to revise this practice.

#### 4.8. OUTAGE MANAGEMENT

In accordance with process approach, the associated director for maintenance conducts the outage management process through projects. As a support to this approach, the outage building was created and all involved personnel are located in it for a certain period of time.

The project team, led by the project manager, is effectively created for every outage and covers the different steps of the outage. All activities, including schedule deviations are reported to the project manager and the steering committee. For each step, main objectives and indicators are established and periodically evaluated. All involved departments sign internal contracts to be aware of their responsibilities.

Among indicators established for each outage, ALARA and waste treatment indicators define objective to reduce personal doses and waste production as low as possible. An evaluation of these indicators is an efficient part of the project assessment.

While performing the outage, safety and risk assessments are performed. The safety engineer is a member of project staff for each outage and he is responsible for safety assessment of work windows within the schedule, regime changes and assessment of all safety related activities occurring while the outage activities are carried out. During preparation, all maintenance activities are a matter of risk assessment and for relevant tasks, risk analysis is processed. Outage results are evaluated permanently and final reports are elaborated. The team considers this safety-oriented approach to be good performance.

Planning and scheduling are part of preparation phase, which starts eight months before each outage. Long-term plans are the base to elaborate the list of activities to be carried out during outage. This approach ensures that activities are calculated for safe, timely and orderly performance, but estimated time of outages is often prolonged. The team encourages the plant to improve this area.

## **BLAYAIS NPP FOLLOW-UP SELF ASSESSMENT**

The OSART review in the area of maintenance enabled us to consolidate the lines of action taken by the site over the past few years, and to benchmark our performance against that of the world's best operators. The reviewers gave managers credit for their commitment to improving operational safety and reliability, by recognising – for instance – the improvements made with regard to plant condition. The reviewers also identified two good practices regarding risk assessment and contractor supervision.

Furthermore, the OSART review also identified ways for us to improve in order to achieve the best international standards. Two areas were identified as being unsatisfactory :

- Foreign material exclusion (FME), with one recommendation being issued,
- Equipment condition, where one suggestion was issued, encouraging us to make further progress.

We have consequently put a great deal of effort into rectifying the shortcomings observed during the OSART review and into sustaining progress actions already underway. Actions implemented by the plant with a view to making continuous progress in the areas of FME and plant condition are presented below.

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

In the area of maintenance (MA) the team has concluded the Maintenance organization has properly identified deviations and appropriate actions have been taken to resolve one of two issues and make significant progress on second item. The Maintenance departments and collaborate persons are deeply involved and committed to improving plant material conditions and enhancing foreign material exclusion (FME) practices.

The systematic approach of the plant to foreign material exclusion, to prevent the penetration of material into equipment or systems while activities are performed, has raised the awareness of personnel regarding to importance of proper behavior, to ensure FME practices, and increased professionalism of the staff. This approach significantly contributes to improve the plant performance and safety.

The long term plans and action plans the plant has presented for the continual effort to improve material conditions are reasonable and detailed. But some aspects of suggestion have not been fulfilled because of time constrains. In addition feedback from different projects

needs to be periodically evaluated and afterward implemented while plans and projects are ongoing.

## DETAILED MAINTENANCE FINDINGS

### 4.1. ORGANIZATION AND FUNCTIONS

**4.1(a) Good practice:** The plant has very effectively implemented the system of supervision of contractors.

For 60% of the plant maintenance activities, the site relies on the services of contractor companies. As part of its monitoring policy, the NPP has set up a structure in order to supervise and evaluate its contractors.

For this purpose, the NPP has provided professional enhancement training to dedicated EDF staff members. This professional enhancement training is based on theoretical and practical training with support of supervisory network. This network is an effective means of exchanging information on good supervisory practices. Also supervision programmes and reports, reference standards, field observation techniques for detecting deficiencies, specialist involvement has been exhaustively implemented, in order to provide the opportunity for rapidly incorporating experience feedback. The feedback experiences database has been set up to build on the work performed by this network.

The structure has brought about ongoing improvements in the quality of sub-contracted work, in terms of nuclear safety, industrial safety, radiation protection and technical performance. It forms part of a sustained improvement initiative.

### 4.3. MAINTENANCE PROGRAMMES

**4.3(a) Good practice:** Effective risk assessment methodology of maintenance activities has been developed and implemented by the plant. This methodology is based on software application of questioning approach to encompassing the areas of nuclear safety, radiation protection, industrial safety, plant availability and environmental protection. The use of a common tool facilitates collation of risk assessments. The tool is cross-functional and adaptable. It encourages a questioning attitude and provides a reminder of basic reference standards. The deployment plan calls for the joint involvement of a network of representatives as well as management and training staff.

Qualitative and quantitative arguments to support risk assessment methodology as a good practice:

- Extension of the risk assessment method to areas other than nuclear safety helps to minimise risks and improve site performance in the areas of radiation protection, industrial safety, plant availability and environmental protection.
- The tool promotes a questioning attitude and provides a reminder of applicable expectations. It facilitates analyses and promotes in-depth investigation. It is an effective means of grouping together risk assessments performed during previous similar activities. It promotes cross-functional links between crafts. Its ability to include new topics makes it an efficient vehicle of site expectations and obviates multiple tools: It has evolved since it was first introduced, taking into account the specific features of risk assessments pertaining to temporary modifications and fuel pool safety areas. It is tracked by a dedicated task force.
- The decision to deploy the “new” risk assessment methodology by involving a network of representatives as well as management and training staff has helped to send out clear and consistent messages concerning the site’s objectives. This has created momentum in the assimilation of this methodology (see performance indicators) and worker support.



#### 4.5. CONDUCT OF MAINTENANCE WORK

**4.5(1) Issue:** Foreign material exclusion (FME) procedures and practices do not exhaustively prevent the penetration of foreign material into equipment or systems while activities are performed. The team observed following facts:

- Maintenance procedures regarding maintenance performance used by the plant are very general standard IN26 except procedures for pool areas, steam generators and reactor pressure vessel.
- There is not evidence of systematic approach to FME, while preparation, execution and supervision of maintenance activities are carried out.
- Bolt not fastened close to fuel pool on floor 20m of fuel building unit 3.
- Event report (FRA) No: 06/02/04 regarding presence of foreign material in pool area was elaborated and evaluated.
- FME preventive measure was not used to defend cooling pump of diesel generator. This happened despite the fact that working group was not on the job site and another crew was in the same room. Usage of equipment cover as a temporary container for nuts was noticed instead of using proper container.
- Lack of prevention of penetration equipment and plug risk, e.g. glove was found in the sump 4RPE 08 PS of pump 4 EAS PO.
- Detection and evaluation of discrepancies in FME behavior and FME prediction is not sufficient and is not in line with industrial standards. Supervision and walk-downs observation training do not sufficiently prepare ‘inspectors’.

The lack of comprehensive FME programme and the plant staff awareness of improper FME behavior could be the root cause of failure or unavailability of safety related equipment or systems.

**Recommendation:** The plant should review and modify as necessary the FME programme and foster the plant staff awareness on improper FME behavior in order to prevent the penetration of foreign material into equipment or systems while activities are performed.

**Basis:** IAEA Safety Standards ref. NS-G-2.5, 3.19, para 6.8 and best international practice.

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

The site has clarified and raised its reference standards.

FME reference standards have been clarified in the plant quality manual : new expectations have been issued for all circuit openings.

A site governing procedure has been written in order to specify measures to be taken in order to meet these new expectations.

The risk assessment database has been expanded in order for work planners to better identify risks and countermeasures.

A supply of industrial-grade covers has been obtained for equipment located outside the RCA.

In order to make them easier to use on worksites, a supply of soft covers has been obtained and made available to workers in the tool stores. These covers are held in place by straps, which can be used to secure them to adjoining structures. These covers can be used to protect all circuit openings measuring from 100 to 1000mm in diameter.

An action plan associated with this initiative is being monitored by the operations safety committee and feedback will be collected after the 2006 trial period, in order to optimise the system before the 2007 outage cycle (strength, cover sizes, stock quantities, etc.).

At the same time, workers have been provided with additional storage facilities on worksites.

Procedures and documents.

Procedures have been reviewed in order to assess whether the foreign material risk has been sufficiently addressed. Expectations seem to have been well incorporated into quality plans and into procedures written or updated since 2001.

In order to ensure that risks have been identified and addressed in cases where work packages containing older procedures do not have a quality plan, a report is attached to the package.

With regard to countermeasures, a special sheet has been produced to help workers choose the appropriate type of cover.

Communication and implementation on worksites.

Worker awareness with regard to risks and countermeasures has been raised during team meetings. Contractors have also been informed on the occasion of meetings held prior to outages, as well as via a document published by the GIE (group in charge of contractor coordination for Western France). A poster has been designed and put up in workshops and on the installation.

Management field inspections are used to monitor implementation of new reference standards in the field, particularly in safety areas around fuel pools. Contractor supervision programmes also address risks associated with foreign materials.

### **IAEA Comments:**

The systematic approach of the plant to foreign material exclusion, to prevent the penetration of material into equipment or systems while activities are performed, is established and implemented. The plant expectations and objectives are defined. Training on FME methods was done with support of WANO feedback; further training is planned for contractors. Action plans for continual improvement have been prepared and approved. Affected procedures are elaborated or updated; risk analysis has been extended to cover FME issues. Necessary hardware measures are available in tool rooms and properly used by maintenance staff.

The plant has successfully improved awareness of personnel regarding to importance of proper behavior to ensure FME and increased professionalism of the staff.

**Conclusion:** Issue resolved



#### 4.6. MATERIAL CONDITIONS

**4.6(1) Issue:** Material condition of the plant needs to be continuously improved to be consistent with management expectations.

The project, “the Plant Material and Equipment Improvement Program” was established for the period 2004-2005. However, the team observed the following facts:

- While performing the plant tours and following observations, these significant finding results have been collected by the team, e.g.:
  1. main feed water pump AET 001 VV is corroded
  2. boron leakage trace on 4 RIS 012 DI, room K 052
  3. poor status of pump and motor 1 PTR 0102 PO including boron leakage from the seal
  4. corrosion of component pipe on 1 DVK 002 RF
  5. unacceptable status of pump 3 PTR 00X PO, mechanical seal boron leakage trace and status of the motor.
- Contrasts in the field were noticed, difference in an approach to material conditions and a housekeeping in the same room and with the same type of equipment is accepted, e.g.:
  6. pump's: 2 CFI 002 PO, 2 CFI 004 PO,
  7. flanges: 2 CFI 002 FI, 2 CFI 004 FI,
  8. labeling: unauthorized storage and marked storage in the Turbine hall -1<sup>st</sup>. unit, level +15m
- Detection and evaluation of discrepancies in material condition and equipment status is not sufficient and is not in line with management expectation.
- Supervision and walk-downs observation training do not sufficiently prepare ‘inspectors’.

Deviations in material condition could result to failure or unavailability of safety related equipment or systems.

**Suggestion:** Continuous improvement of the plant material and equipment, to avoid deviations, should be considered by the plant in order to be consistent with management expectation.

**Basis:** IAEA Safety Standards ref. NS-G-2.4, para 3.1 and best international practice.

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

Actions taken by the site to address this suggestion have been combined with those taken to address recommendation no. 1.3(1) in the MOA review area.

The following main actions have been taken in order to improve material condition :

- Implementation of periodic rounds within the maintenance departments in addition to those carried out by Operations, in order to monitor equipment condition (mechanical condition, labelling, external appearance, etc.),
- Widespread use of start and end-of job reports, used by EDF supervisors to check equipment condition at the end of a job,
- Repainting of equipment wherever necessary.

In addition to these actions, the rotating equipment department has launched a campaign to eradicate oil leaks in order to come up with technical solutions for putting an end to oil and Fyrquel leaks around the following systems : feedwater pump turbine lubrication and control fluid system ; circulating water pump lubrication system ; circulating water system ; turbine lubrication ; jacking and turning system ; generator seal oil system and turbine lube oil treatment system.

In order to do this, teams of two persons, comprising planners and technicians, have been assigned to each system in order to make an accurate leak diagnosis and find technical solutions to the problem (benchmarking, discussions with manufacturer, etc.). They regularly file electronic reports on the progress of their efforts.

#### **IAEA Comments:**

System for improvement of the plant material conditions is established and implemented. The plant expectations and objectives are defined. Effected processes and projects have been identified and responsible persons for individual projects have been appointed. Continual training on observation methods and supervision on field for different levels of managers and staff has been set up, scheduled and partially done up to date. Further training is planned with deadline by the end of 2007. Long term plans have been prepared, budgets allocated, activities scheduled, targets and success criteria defined. All involved parties have been identified, cross functional groups and relations have been defined and established. Rules and procedures are elaborated and some have already been applied.

The plant has presented a continual effort to improve material conditions, but some aspects of suggestion have not been fulfilled because of time constrains. In addition feedbacks from different projects have to be periodically evaluated and afterward implemented while plans and projects are ongoing.

**Conclusion:** Satisfactory progress to date.

## 5. TECHNICAL SUPPORT

### 5.1. ORGANIZATION AND FUNCTIONS

The technical support function is spread among many departments. Responsibility of each department is well documented in the organization note of the quality manual. In the quality manual, roles and job processes are well documented according to each of the plant activities. As for the engineering department, it was newly established in March 2005. Before establishing the new department, a study was made by benchmarking other French plants whose engineering department is working well. It is interesting that modification coordinator is assigned in the engineering department, although the plant has a dedicated modification department. This serves to monitor and coordinate modifications independently.

Performance indicators are established and are reported for review to the plant manager twice per year. In the organizational note of the engineering department, it is clearly described that safety is priority.

There are many support organizations in the EDF corporate level. Corporate Engineering Support for Operation (UNIFE) is responsible for modifications at the corporate level for surveillance testing rules and core calculations. UTO deals with operating experience with regard to unit outages and generic maintenance matters. Corporate Operations Support Centre (CAPE) is responsible for coaching of operational experience and corporate requirements, and performs as a base for the corporate support in case of an event. There are also other entities responsible for engineering and fuel design.

The plant made a contract with DIN and DPN by protocols and conventions. A meeting is held among them each year to review the contract. Some engineers from the corporate entities are assigned in the plant, which makes the relationship more effective. In case of problem requiring corporate level support, the plant calls on DPN to set 'permanence' (permanent phone contact). Thanks to this contract, the plant can get the necessary support from all corporate level entities at any time. Thus, the interface with corporate level entities is clearly defined and reviewed regularly. The team considers this as a good performance.

A training coordinator is assigned in the department and is responsible for qualification and skill development in collaboration with the support from the skills development department. In the plant, there is a specialist who can use NASTRAN (elastic-plastic stress analysis) code. This skill was used to find the root cause of a problem. The team considers this as a good practice.

### 5.2. SURVEILLANCE PROGRAMME

UNIFE develops the general surveillance testing rules, summary tables and amendment sheets. A committee meeting between UNIFE and plants is held every three months, and the requests from the plants is communicated and adopted. The process and interface with UNIFE, including urgent situation, is clearly defined and working well.

In the plant, the engineering department receives the corporate request and appoints a coordinator in the Safety Quality Department (SSQ). This coordinator organizes a meeting with the surveillance coordinator from the relating department to assign the responsibility for developing the procedure and implementation of testing with deadline. A corporate request

committee is held every two weeks and monitors whether the procedures are being developed in a timely manner. The SSQ coordinator is responsible for upgrading the plant surveillance rule after the committee meets. The SSQ coordinator is also responsible for screening, performing an impact analysis and reporting when a deviation is found. Thus, the responsibilities, roles and interface in the plant organization are clear and well organized.

The FAQ database about the surveillance programme is developed and available for all plant staff through the intranet. This information is also communicated with UNIPE and other French NPPs at the corporate level committee. The team considered this as a good practice.

When a procedure needs to be changed or created, the responsibility for developing, reviewing and inputting it to the plant database (SYGMA/PRV) is assigned to each department, and the modified or new procedure is approved in the line department. However, an independent check from other departments that are affected by the procedure change and SYGMA/PRV are not conducted in the validation process.

The surveillance programme is managed by SYGMA/PRV and is updated when necessary. The PRV creates the list of required surveillance tests in three weeks on the operating plant. Based on this, a list schedule chart of testing is drafted by the Multi Year Projects Scheduling department one week ahead, and updated daily. Using this schedule chart, conflicts are avoided in advance. Each department is responsible for making sure that testing is conducted properly. The shift supervisor gives the final approval before conducting the test. After testing, each department is responsible for inputting the test results into SYGMA/PRV. During the outage period, the outage group in the operations department is responsible for reviewing and reporting any deviations from the test. The process and roles of individuals are clearly defined.

Acceptance criteria are clearly defined and well described in the each test procedure. It makes a clear distinction between criteria A (nuclear safety) and B (equipment) that need to be complied with, and after assessing seven criteria, the test result are classified as satisfactory, satisfactory with reservation or not satisfactory. Following up on the unsatisfactory testing results is also defined.

Independent monitoring and review of each surveillance activity is regularly conducted by SSQ. As the plant identified 12 significant operating events (SSE) relating to surveillance tests, the BLA 88 project was established to enhance surveillance activities. However, there is room to improve the surveillance process to ensure the surveillance activities are properly conducted. The team made a recommendation in this area.

### 5.3. PLANT MODIFICATION SYSTEM

Plant modifications to safety related systems are planned at the corporate level to reflect OE, technical evolution, new requirement and safety re-evaluation. The decision is made in the committee held between DPN and DIN. UNIPE draws up the specification and master schedule. Each modification is categorized in three categories and depending on this categorization, the implementation timing is decided as to whether it is implemented during the ten-year outage or in the early stage (during periodic outage or operation). The modification schedule is decided by agreement between UNIPE and the NPP. They meet four times a year for normal operation and eight times for outage related modifications. A work package, which is applicable to standard 900MW EDF plant is developed by UCE under DIN.

Design, validation, impact analysis and risk assessment is conducted to develop the work package by UCE. The plant is responsible for implementing the modification. After the modification, its operating experience is collected and fed back to the each corporate level for the next NPP's modification. Responsibility between plant and corporate level entities is clearly defined and review process exists.

The Joint Modification department (EC) is responsible for monitoring and coordination of the corporate level modification. For each modification, a special coordinator is appointed. About 20 experts are in the EC from corporate level entities to support and coordinate the modification. The team considers this as a good performance.

Five months before the modification, a modification committee, chaired by deputy associate technical director, is held. Four months before, the first validation is made and it is approved by the technical director. A report to safety authority, document preparation and setting up the schedule is then conducted. Preparation, follow-up, monitoring, testing and re-qualification of the modification programme and updating the plant documents are described in the plant quality manual. In 2004, all planned modifications during the outage were conducted and 82% of the planned modifications during operation were conducted. These values were the highest among the EDF NPPs. Thus, the plant modification and its review process are clearly established. However, the correction process for the modification procedure is not always properly controlled and used. The team made a suggestion in this area.

For modifications during the outage period, completion of the modification is declared by a coordinator in EC. For modifications, which are conducted during operation, a coordinator in EC checks that all necessary activities are completed, except for post modification test. The post modification test is conducted by the operations department and completion of the modification is declared by the shift operations manager. The hand over process is well defined.

For modifications for safety related systems, a training plan is prepared at the corporate level, if required. The skills develop department is responsible for training. The training process for safety related system modifications is clearly defined.

For a modification, which is requested by the plant and conducted by the plant, the request is reviewed in the modification committee and technical committee. The classification of modifications by safety significance is clearly defined. If it is judged as safety related, it is sent to the corporate level for processing.

From the beginning of 2004, the plant set up a project to reduce the temporary modifications and to control it in a better way. Before initiating a temporary modification, a risk analysis (safety, availability, industrial safety and RP) is required. Risk of installation and removal and risk of forgetting of temporary modifications are also included. The applicable reactor condition is also identified during this process. Validation is made by the shift operations manager. Risk analysis, description of the temporary modification and condition of removal and deadline of the temporary modification are inputted in the 'AIC' system. The AIC includes a link to the associated work permits and flow diagrams, allowing this information to be accessed from any computer of plant intranet. The status of temporary modifications is reviewed by the operation department every four months for each unit in operation. During the outage period, the outage committee (COMSAT) is responsible for monitoring it. These activities are clearly described in the plant quality manual. 126 temporary modifications have



been eliminated since August 2004, and this project seems to improve the situation. However, the present number of temporary modifications can be still considered as high and there is room to improve the temporary modification activities. The team made a suggestion in this area.

#### 5.4. REACTOR ENGINEERING

The Fuel Branch of UNIPE (UNIPE/BC) has the main responsibility for the fuel activity and its relations with the NPP are formalized in a protocol. UNIPE/BC provides the core loading pattern and necessary core and fuel data. It processes and analyses the core parameters, which were measured at the plant. In case of unexpected condition, it supports the plant by the contract between plant and UNIPE/BC. The engineering department is responsible for providing assistance and support in all testing stages, in particular, zero power physical tests.

The Chemistry and Testing Department (ECE) is responsible for the monitoring and testing of core physical parameters and adjustment of parameters related to the operation, monitoring and protection of the core. It is also in charge of preparing and carrying out physical start-up tests. The I&C department is responsible for calibration of the instruments with the data calculated by ECE. The operations shift manager gives the approval of any operation. The Logistics Department is responsible for the physical management and bookkeeping of nuclear material. Thus, although many departments are involved, each responsibility is clearly and comprehensively established.

In the physical start-up test, critical boron concentration, doppler coefficient, total and difference of control rod worth and moderator temperature coefficient are measured and compared with design value. During power up, measurements are conducted in five stages. Nuclear enthalpy rise, hot channel factor and radial and axial power distribution are measured and compared with design value. The thermal balance test of the primary and secondary circuit is conducted and calibration value is calculated. Calibration of primary circuit flow device and neutron detector is implemented. During normal operation, flux map and thermal balance measurements are conducted every 30 EFPD. Neutron detectors (ex-core) are calibrated every 90 EFPD. Calibration of gray rod coefficient is conducted every 90 days. Before the stretch out operation flux map measurements are conducted and calibration is conducted one week before the stretch out operation. During the stretch out operation, the thermal balance is measured daily, and flux map is measured every 20 EFPD and just before shutdown. These activities are defined in the safety quality plan. Thus, the core parameters are timely and adequately monitored.

#### 5.5. FUEL HANDLING

The Logistics Department is responsible for the coordinating of all interfaces associated with the fuel handling, drawing up and ensuring compliance with the schedules of fuel acceptance and shipment. It carries out all fuel handling operations. The operations department gives clearance of fuel movements. During fuel handling operations, the operations department makes sure that the specifications related to the containment of the fuel building are complied with. The engineering department is responsible for providing assistance and support in all stages of fuel handling, acceptance and shipment, the second level analysis of fuel handling incidents, the analysis of equipment use and external OE analysis. The Risk Prevention Department is responsible for radiological checks on all activities of the fuel handling. Responsibility is clearly defined.

New fuel storage and inspection is conducted by stipulated standards.

All spent fuel, which can be loaded again, is checked by camera during the unloading.

Fuel loading and unloading is conducted using clear procedures and each fuel movement is recorded. Several measures were taken to prevent miss loading during fuel operations. During the loading and unloading of fuel, neutron count, boron concentration and temperature are monitored regularly and alarm is changed if necessary. These measures seem comprehensive to prevent a critical accident. During reactor core loading, the plant uses a simple mechanical device, which ensures the safe positioning of fuel assemblies in the core. The team considered this as a good practice.

The spent fuel pool bridge, which is used to move the fuel, was found parked over the spent fuel pool. SSQ department decided that this bridge should be parked over the spent fuel pool with a radiation field monitor in order to measure the radiation environment of this area. Although a seismic analysis was conducted, the team encouraged the plant to reconsider the parking position by taking international practice into consideration.

Records of the fuel information and history are inputted into the computer and it is easy to retrieve.

Spent fuel pool and its surrounding areas are defined as FME area and measures are taken to prevent foreign material from falling into pool. Logistics department is in charge of FME in this area. However, the team observed a FME problem during the mission. (See Maintenance section of this report.)

## 5.6. COMPUTER APPLICATIONS IMPORTANT TO SAFETY

Among all applications, the plant identified 95 applications as safety related applications. It is required to conduct a risk analysis for safety related applications by the plant quality manual. As a result of each risk, safety related applications are classified into three categories. This requirement is established in 1997 at the corporate level and introduced to the plant from 1999. Until now, a risk analysis for safety related computer application is completed for only 56.8%. This matter is now being dealt with by the Safety Committee and a completion target is set at the end of 2006.

Computer application used at plant is prepared by either corporate (DPN) or local. For corporate level application, DPN is responsible for developing and maintaining it and plant's Information System department (SSI) is responsible for the risk analysis of integrating it into the plant. At the corporate level, DPN made a contract with Department Division (DS) about maintenance of the system and application. A committee of Information System among plants and corporate level is held three or four times a year to review the service provided with the plant. Also, a committee of local IT and other meetings are held every three months among plants and SEISO (local entity of DS). For local application, each department is responsible for developing and maintaining it. The assistant resource director is responsible for ensuring the corporate request is adhered to and providing necessary resources and computer support. Some of the responsibilities are delegated to the head of SSI. These activities are reported to the resource committee and reviewed. Thus responsibilities and interface are clearly defined and regularly reviewed. However, validation of local computer application is not systematically monitored and reviewed. The team made a suggestion in this area.

Computer maintenance requests are tracked and almost all are completed.

Back up of the data is conducted every night. The SEISO is responsible for emergency recovery and is available 24 hours a day even on holidays.

End users satisfaction is tracked by SEISO and if it is not satisfactory, the plant can request counter measures in accordance with the contract.

Only authorized SSI staff can conduct document uploading to the system and the version control of the document is organized well. Access to the important data is allowed only for authorized person and is controlled by the SSI.

### **BLAYAIS NPP FOLLOW-UP SELF ASSESSMENT**

The OSART mission conducted in May 2005 provided an enlightening independent appraisal of the technical support area. It helped us to gain a better sense of the need for thoroughness in the monitoring of design compliance.

Each of the observations made during the review has been addressed by an action plan, the aim of which is to :

- Reduce deficiencies,
- Set up a long-term structure to ensure that standards are sustained over time.

Progress of these action plans is periodically monitored by site senior management. The action plan implemented by the site in order to comply with surveillance test frequency and process deficiencies associated with surveillance tests has been completed. Since the OSART mission, we have not detected any more major deficiencies and low-level events are being used to conduct effective trending.

Similarly, temporary plant modifications (DMP) are now being very closely monitored. We have undertaken to reduce the number of temporary modifications by converting them into permanent plant modifications when this is justified.

The site has also realised that RP shielding equipment could be detrimental in the event of an earthquake. An exhaustive inventory has been conducted and a schedule has been drawn up to deal with remaining deficiencies. It should be noted that a safety-significant event was reported on this topic in 2005, after finding some shielding equipment that was not seismically qualified. It is important to ensure that software with a potential effect on safety is reliable and that the use of this software is secured. For this purpose, a list of relevant software has been drawn up and a risk assessment has been performed for each application. At the end of June 2006, 93% of software applications had been secured and our aim is to complete this major operation by the end of 2006.

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

On the surveillance activities, diagnosis of the deficiency was made and action plans were developed. Action plans cover implementation, monitoring and reviewing of surveillance activities. At the time of follow-up visit, about 95% of these action plans were implemented.

As a result, in 2006 until the end of October, there was one event, which violated the surveillance criteria, but it was found and corrected by their enhanced surveillance monitoring programme.

The plant has been taking necessary and concrete measures not only on the number of temporary modification but also on the quality of the temporary modification activity. The number of temporary modifications is decreasing toward the target. Among the identified fact of the OSART mission, the plant handled and resolved the lead blanket issue very quickly.

The team concluded this as issue resolved, on the plant side activities (local modification). However, the 2/3 of long-lasting (more than 5 years) temporary modifications might still exist as these need corporate level approval. The team encouraged the plant to continue strong request to the corporate level.

The plant procedure to control correction process on document of modification activity was changed. The head of the testing section of the modification department also requested and checked justification on each correction. The team reviewed recent documents on modification activity and found that correction was made properly. Also it was confirmed that the modification of the criteria I or S was tracked properly.

The team observed two examples, in which the validation of IT function was conducted. Procedure, application guidelines and validation sheet have been created for software validation. However this has been done just recently and further action is planned for 2007.

## DETAILED TECHNICAL SUPPORT FINDINGS

### 5.1. ORGANIZATION AND FUNCTIONS

**5.1(a) Good practice:** The NPP has set in place all the requisite skills as well as a tool (NASTRAN; stress analysis) for assessing equipment stress levels as part of mechanical studies relating to:

- detected deviations
- projects for making improvements

The finite element calculation method encompasses the latest developments in performance including dynamic calculations, non-linear calculations etc.

The NPP has created the new job position of mechanical calculations expert. The position is assigned to an engineer with experience in maintenance, safety and operations. Hypotheses and results from the calculations are checked and analyzed by experts either within or from outside EDF.

## 5.2. SURVEILLANCE PROGRAMME

**5.2(1) Issue:** The surveillance implementation, review and monitoring programme does not always assure that surveillance testing of safety related systems is comprehensively and periodically conducted.

The BLA 88 project was established to enhance surveillance activities. However, the team observed the following facts:

- In 2004, plant identified 12 significant operating events (SSE) relating to surveillance test.
- In 2005, up to April one SSE relating to surveillance test have been identified.
- In 2004, 12 recommendations were made according to the result of independent random check by SSQ. Among them two were classified SSEs which did not identify in the responsible department.
- In the procedure EP02ASGD, there is no check off for one item, although it is surveillance item required in the surveillance rule, it was not identified by 1st review (checked by operator), 2nd review (operation department)
- In the procedure EP01COR013 dated 30/04/05, there are some corrections without signature. For example;
  - Two of them are relating to surveillance rule and as this correction weren't correct, their criteria were changed.
  - In the comment column, limit of power up rate was corrected because the printed value was wrong. As procedure was revised two years ago, such correction might last for two years.
- In the procedure EP01COR013 dated 30/04/05, some value relating to surveillance rule, number of effective digits after decimal were inconsistent. Round up or round down was not clear.
- Correction by scratch off without signature and date was found on test implementation date in the procedure EP04ASGD dated 23/04/05.
- 43 surveillance tests were identified as exceeding of the deadline according to SYGMA/PRV database, although there is no deviation at that moment. For example, completion time limit is not properly inputted especially for outage surveillance test.
- Although some group started trend analysis on surveillance results, it is not conducted in a systematic way in the plant.
- Comprehensiveness of surveillance data (surveillance item, periodicity, criteria) of SYGMA/PRV has not been reviewed, although they fully depend surveillance activity on SYGMA/PRV.

Without comprehensive and periodic surveillance activities the plant could fail to detect the unavailability of safety related systems.

**Recommendation:** The plant should continue to enhance the implementation, review and monitoring of surveillance related activities to assure that the surveillance testing of safety related systems is comprehensively and periodically conducted.

**Basis:** IAEA Safety Guide NS-G-2.6; Maintenance, Surveillance and In-service Inspection in NPPs, para 9.1-9.46.

**Plant response/action:**

Following the poor results achieved in 2004 in terms of safety-significant events associated with surveillance tests, site senior management decided to initiate a site investigation (BLA 88).

On the basis of diagnosis and benchmarking, an action plan was drawn up and approved by the safety technical committee on 02/02/2005. The aim is to improve the surveillance test process falling with the scope of chapter IX of the General Operating Rules.

Drawing on the findings of the OSART mission, this action plan has been effective in improving surveillance activities while at the same time standardising practices. The following main actions have been implemented :

- Clarification of craft and project responsibilities; definition of expectations via a quality manual procedure,
- Upgrading of site reference base; setting up of a new craft representative network; compilation of a list of applicable documents; improved quality of reference documents,
- Compilation of a work schedule including surveillance tests,
- Improved monitoring of all phases forming part of the process: checks to ensure proper preventive maintenance (PRV) scheduling within all crafts, monitoring of PRV indicators common to all crafts, monitoring process documented in surveillance test acceptance report, specific monitoring sheets for surveillance tests used as part of craft monitoring programmes,
- Trending programme for the most critical surveillance tests,
- Professional enhancement training, supported by the procedures/methods network and sections.

The trend in performance indicators shows a significant improvement in control over surveillance activities since 2004 : the number of safety-significant events and precursors (safety-related events, local event reports, safety/quality recommendations) has dropped sharply.

In 2006, in spite of reinforcement of the level standard, on October 30th 2006, only 3 safety significant events occurred to challenge the surveillance test process falling within the scope of chapter IX of the General Operating Rules. These 3 events, amongst which 2 are quality assurance deficiencies, do not call into question the chapter IX process of General Operating Rules. The number of low-level events associated with sub-standard recording of information and with adherence to expectations is also dropping.

Furthermore, as part of the corporate “standardised practices and methods” project (PHPM), all surveillance tests coming under chapter IX will be reviewed. In the area of operations, the deadline has been set for the end of 2006. The aim of this initiative is to standardise surveillance test procedures and thus improve their quality.

Efforts made to clarify our organisational structures and make the process more reliable via the PHMP project should help us to further improve surveillance activities for tests falling within the scope of chapter IX.

All necessary actions have been taken and finalised to improve the chapter IX performance. The plant considers the issue resolved.

#### **IAEA Comments:**

Diagnosis of the deficiency was made and action plans were developed. According to the diagnosis, human factor and organization/management were identified as the main contributors to these deficiencies. Action plans took them into consideration and cover implementation, monitoring and reviewing of surveillance activities. Monitoring has been conducted in every step of creating or modifying the surveillance activities. The review process includes thorough review of the SYGMA input, which is compared to the plant General Operating Rules Chapter 9. It has been conducted every year and the plant already identified and corrected the deficiency in 2005. EDF corporate request the review of the surveillance work procedure in the area of operation and plant is reviewing with a target of completing it by the end of 2006.

At the time of follow-up visit, about 95% of these action plans were implemented.

As a result, in 2006 until the end of October, there was one event, which violated the surveillance criteria but it was found and corrected by their enhanced surveillance monitoring programme. Some deficiencies which, relating to quality or the rigorousness of the surveillance activities have being identified by their enhanced monitoring programme and through these activities the awareness of this issue has been raised continuously.

**Conclusion:** Issue resolved.

**5.2(a) Good practice:** Assistance and advice is provided by the safety and quality department (SSQ) through the use of questions and answer sheets (called ‘FQR’). In particular, these are used for applying the general operating rules relating to surveillance activities.

The question raised by the line departments and the answers provided by the SSQ are formalized and used via question and answer sheets. These sheets are accessible to all players through computer network as FAQ.

These sheets contain not only the reference standard from general operating rules and the questions raised by the line departments, but also extracts from background policy that lead to aspects of reference standards being made clear.

These data are exchanged with corporate level and other NPPs and feed back from other NPPs is conducted.



### 5.3. PLANT MODIFICATION SYSTEM

**5.3(1) Issue:** The plant's temporary modification programme is not comprehensive regarding identification, impact analysis, limited initiation, marking and timely termination.

- The total number of temporary modifications in effect at the plant is 171. (36 of them have been in existence for more than five years.)
- Unauthorized temporary modification were found;
  - Handwritten tag in room L501 related to FM KRT 106 displays correct information about a permanent modification, but its format is not in line with plant procedures.
  - Handwritten tags 3 EPP 007 UB, 3 RCV 570 EC and 8 KRT 503 UB displaying information „not connected“ are not valid and their format is not in line with plant procedures.
- Team indicates the following modifications;
  - Temporary modification 8 GMP 264 TR was first installed in 1990 when shift manager's office was created, and ventilation was modified which could have been initiated at that time as a permanent, not a temporary one
  - Temporary modification 8 GMP 265 TR was installed in 1996, to solve the problem that spare parts for a type of this chart recorder were not any more available which could have been initiated at that time as a permanent, not a temporary one;
  - Temporary modification 4 GMP GSE (removal of steam valve) was installed in 1993, its termination is not clearly defined;
- Although many lead bags are put on the pipes without any identification, which may affect on static load design and seismic design, the plant does not make impact analyses and does not control them. For example;
  - Lead blankets laid on an overhead pipe in W213;
  - About 1.5 tons of lead blankets were found in nuclear auxiliary building level 0.
- There isn't a rule which stipulate the maximum period of temporary modification, although rule requires to remove as soon as possible.
- Although there are many temporary modifications in the plant, its impact on other modification activity is not systematically taken into consideration.

Without proper configuration control of temporary modifications, this could result in configuration problems related to systems important to safety.

**Suggestion:** The plant should consider further enforcing expectations regarding, comprehensive identification, impact analysis, limited initiation, proper marking and timely termination of temporary modifications.

**Basis:** IAEA Safety Guide NS-G-2.3; Modifications to NPPs, para 6.1-6.9.

## **Plant response/action:**

### 1. Reinforcement of plant requirements in updating reference standards

The analysis of the OSART suggestion led the site to raise of its expectations for temporary modifications. If the temporary modifications definition covers the case of shielding equipment, because of operational considerations, the plant decided to define through one separate report the specific rules relative to shielding equipment. Currently :

- the plant governing procedure setting out requirements for temporary modifications has been updated (excluding shielding equipment) (ref. D.5150.NAS.MQ.D2.AUT.0001) in order to include two new principles :
  - Number of temporary modifications restricted to 30 per unit (i.e. 120 for the whole site),
  - Service life of temporary modifications limited to 5 years maximum.

In order to meet these ambitious targets, the plant has set itself a deadline for March 2007.

- a specific procedure (ref. D.5150.NT.LOG.0049) defining the basic rules for installation of shielding equipment was written.

### 2. Reinforcement of action plan related to “temporary modifications”

The implementation of the action plan “temporary modifications” initiated in August 2004 was continued with a priority given to two main fields :

- the global reduction of temporary modifications with a specific focus on the oldest temporary modifications (focus on quantity),
- the increase of monitoring performed on temporary modifications in order to guarantee that all expectations are concretely fulfilled on the field (focus on quality).

#### 2.1. Reduction of temporary modifications

The implementation of the action plan concerning the reduction of temporary modifications was continued with emphasis on monitoring tools specified in the plant’s reference documents:

- for the period when the plant is in operation : reinforcement of expectations related to performance of quarterly surveillance tests DIV 70 ;
- for outages : stepping up of reviews conducted before and after outages;
- for the oldest temporary modifications : specific work in conjunction with temporary modification coordinators in each department.

Results achieved :

- the total number of temporary modifications shows an ongoing gradual drop : from 203 temporary modifications in 08/2004, 171 during the OSART inspection in 05/2005, there are 143 temporary modifications registered on the plant on the 30<sup>th</sup> of October 2006. This number is the result of a momentum of :
  - dismantling : for example, the specific work performed during outages enabled in 2006 the removal of 35 temporary modifications,

- mounting : for example, among the 143 temporary modifications in place at the end of October 2006, 27 were created to enable serenity in the control room.
- with regard to temporary modifications in place for more than 5 years, the action plan implemented in conjunction with craft coordinators produced satisfactory results :
  - of the 66 temporary modifications in place for more than 5 years in 05/2005, 27 remain in place on the 30<sup>th</sup> of October 2006,
  - concerning these 27 remaining ones, all the actions to remove them have been launched. For the 2/3 (modifications of safety-related equipments), the plant is dependant on corporate answers and timing, for the remaining 1/3, local actions will enable to remove them before March 2007.

## 2.2. Increase of monitoring performed on the implementation of temporary modifications requirements

In order to improve the quality of temporary modifications, the plant increased its requirements in terms of monitoring tools specified in the plant's reference documents :

- the quarterly surveillance test DIV 70 : through this test :
  - during the first stage, the shift supervisor checks the risk analysis for each temporary modification, its removal date and asks department representatives for corrective actions if necessary,
  - during the second stage, the department representatives conduct the same monitoring on the field and in the documents filed in their offices.

Thus, non authorised temporary modifications can be detected, correction of risk analyses can be requested and if necessary, the removal of temporary modifications.

- regarding the management monitoring performed inside of each department : through a monitoring plan defined inside of each department, the management and intermediate managers conduct controls. For this purpose, a specific monitoring file has been defined in a Lotus Note database entitled "presence in the field". In this file, all the monitored criteria related to temporary modifications are specified (for example : 5 criteria enable to check the quality of the risk analysis, 3 criteria check the proper labelling).
- regarding the monitoring performed by the action plan coordinator: these regular monitoring (6 complete monitoring since the OSART) consist in checking for each temporary modification its compliance through the IT application.

### Results achieved :

The different monitoring tools performed enable :

- to remind regularly requirements related to temporary modifications,
- to correct the non compliance and to guarantee on a long-term basis the quality of temporary modifications.
- the coordinator to study major trends through the monitoring database and the most frequent difficulties encountered related to the implementation of requirements : this analysis shows

that at the end of 2006, the site must concentrate its efforts on the improvement of the treatment of temporary modifications related to safety.

### 3. Creation of a specific action plan about shielding equipment

#### 3.1. Action plan

A specific action plan including the following actions has been drawn up :

- Writing of a procedure on basic rules for the installation of shielding (permanent and temporary),
- Inventory of shielding equipment (stationary and mobile) and review to justify the need for it to be in place,
- On the basis of this inventory, implementation of a programme to upgrade shielding equipment,
- Setting up of a shielding management system,
- Seeking solutions in order to process the deficiency identified by the OSART reviewers (room W213 on unit 3), regarding the nuclear island vent and drain piping manifold.

#### 3.2. Methodology

An ALARA working group has been set up to address this issue, coordinated by the logistics department and involving the RP department and contractor responsible for the installation of shielding equipment (PGAC).

The engineering and safety/quality departments have also been involved in investigations into earthquake resistance and safety analyses.

The action plan was approved by the risk prevention committee on 10/11/05. A status check was conducted by this committee on 03/05/06.

#### 3.3 Results achieved

The progress of each action is described in detail below:

##### Action 1 : Procedure written on rules governing the installation of shielding equipment (permanent and temporary) :

Reference standards are described in procedure D5150NTLOG0049, approved in June 2006. This procedure includes :

- Technical installation rules, such as the need to address seismic risks by specifying requirements in reference standards ;
- Mechanical resistance of piping, based on the UTO summary document dated March 2006 (reactor coolant/safety injection lines subject to design-basis criteria);
- Installation system and responsibilities (interfaces with supplier, incorporation of UTO requirements for work with radiological risk).

##### Action 2 : Inventory of shielding equipment (stationary or mobile) and review to justify the need for them to be in place :

This inventory was carried out on all 4 units in January and February 2006. A tracking document for actions 2 and 3 has been written in order to monitor completed actions and outstanding points.

Action 3 : Implementation of a programme to upgrade shielding equipment following completion of inventory :

The review conducted by the RP, logistics, SQ and engineering departments resulted in the removal of shielding on the spent fuel and reactor cavity cooling and treatment system and the CVCS system. The only shielding equipment which was left in place had passed seismic and mechanical resistance calculations.

There only remain two outstanding points. The first one concerns nuclear sampling heat exchangers : seismic resistance is currently being considered by the corporate engineering support (CIPN). We expect these results by the end of 2006. The second point relates to the nuclear island vent and drain piping manifold on unit 3 in room W213. And the piping is scheduled to be replaced in January 2007.

Action 4 : Setting up of a shielding management system :

On the occasion of the benchmarking activity performed on this issue in conjunction with Tricastin NPP, we found out about an electronic tracking program used by Tricastin NPP, and learned about the various possibilities and benefits offered by this type of monitoring. We have already produced and put into practice reference sheets (“Fiches Réflexes”) for installing shielding equipment during the outages of units 2 and 4. These reference sheets were developed with the help of our corporate technical support (UTO).

Our choice of tracking system needs to be finalised in liaison with our supplier PGAC.  
Deadline: scheduled for December 2006.

Action 5 : Seeking solutions in order to process the deficiency identified by the OSART reviewers (room W213 on unit 3), regarding the nuclear island vent and drain piping manifold :

Replacement of piping on the unit-3 nuclear island vent and drain manifold (local W213) is scheduled for January 2007. Once this is done, shielding installed on the ceiling of this room can be removed.

CONCLUSION

The OSART mission has helped the plant to further reinforce its requirements with regards to temporary modifications. The inventory of shielding equipment that was performed allowed the plant to carry out an exhaustive check, to carry out seismic and mechanical resistance studies and to eliminate all the non compliant shielding equipment. By setting ambitious targets for the beginning of 2007 on temporary modifications, the plant has endeavoured to revitalise the action plan from a quantity and quality point of view. Concerning these objectives, the plant is now well on the way to achieving them. These satisfactory results make it possible for the plant to :

- be more ambitious about the maximum life span of a temporary modification by introducing this new rule : “a temporary modification should be removed before the next VP outage (2-yearly outage with important maintenance activities)”,

- concentrate its efforts on the improvement of the treatment of temporary modifications with related to safety.

**IAEA Comments:**

Requirement for the total number and the service life of the temporary modification was settled. The plant has been taking necessary and concrete measures not only on the number of temporary modification but also on the quality of the temporary modification activity. The number of temporary modifications is decreasing toward the target. The team confirmed that long-lasting (more than 5 years) temporary modifications which can be controlled by the plant will be all eliminated by March 2007.

Among the identified fact of the OSART mission, the plant handled the lead blanket issue differently as they thought that it was important and project base activity was needed. All installed lead blankets in the field were surveyed and impact analysis including seismic analysis and mechanical resistance analysis were made to all of them. According to the result of impact analysis, the blanket which had impact on safety equipment was removed and was reported as a SSE. The team also checked the control document of these.

The team concluded this as issue resolved, based on the plant side activities (local modification). However, the 2/3 of long-lasting (more than 5 years) temporary modifications might still exist as these need corporate level approval. Although the plant requested the termination of these temporary modifications, there is no information when they are solved by the corporate level. The team encouraged the plant to continue strong request to corporate level.

**Conclusion:** Issue resolved.

**5.3(2) Issue:** The correction process for procedure related to plant modification is not properly controlled and used.

Correction of the modification procedure is conducted with strike out or adding words or sentences by hand. Each correction does not have signature although only cover page was signed. It was conducted complying with local and national level quality manual of modification P55.

- In the modification procedure ‘REE SEC 016 BL3, PNXX1097D’ the following examples were found;
  - Two acceptance criteria were struck out without signature and data. As this procedure was prepared by corporate level, corporate approval was needed to change it. But corporate approval was conducted orally and this approval was not documented.
  - Some data were written outside the stipulated column.
  - A lot of correction by scratch and strike out and adding words or sentence without signature and data were found.

Without proper control and use of procedure, modification might not satisfy design intention.

**Suggestion:** Consideration should be taken for enhancing the proper control and use of corrections in the modification procedure.

**Basis:** IAEA Safety Guide NS-G-2.3; Modifications to NPPs, para 7.2, 9.1.

**Plant response/action:**

Procedure P55 of the joint modification structure's quality manual, an adaptation of the corporate quality manual, has been updated to ensure that any mark-up to an approved testing procedure must be accompanied by the words marked "approved, rev. number" opposite the corrected sections, with the signature, document rev. number and a justification.

A department procedure has been written for members of the testing section, reminding them of this rule. The section head or his deputy verify compliance of testing documents every time the revision number changes.

Any updates to criteria or to methods determining these criteria are now formally recorded. The post-modification test monitoring application has been duly updated to support a detailed tracking function.

**IAEA Comments:**

The plant procedure to control correction process on document of modification activity was changed. When correction is made to the document of modification, it is required to put a signature and date on it and to get an approval of correction from head of testing section. When this correction is relating to safety criteria I or S, the approval form corporate level is required. The head of testing department also requested justification on each correction. As this justification has helped him to judge the correction is made appropriately and it was conducted without problem, the plant is going to include this process as one of official requirement for the correction process of modification.

The team reviewed two recent documents on modification activity and found that correction was made properly. Also it was confirmed that the modification of the criteria I or S was tracked properly.

**Conclusion:** Issue resolved.

## 5.5. FUEL HANDLING

**5.5(a) Good practice:** During reactor core loading, the plant uses a simple mechanical device which ensures the safe positioning of fuel assemblies in the core.

This device aims to make fuel assembly reloading operations easier. It is controlled by the fuel loading machine, which positions it on the core support plate as same as fuel assembly.

It guides the fuel assembly during its landing on the plate and more specifically, adjusts the orientation of the bottom nozzle so as to facilitate positioning on the core support plate's alignment pins.

This device offers the following benefits:

Increase safety during fuel handling

- Reduced number of modifications to reloading sequences: the tool bypasses the need for 180 degree turns or for temporary storage due to deformation of the handled fuel assembly or adjacent assemblies in the core.
- The loading method used limits friction damage between assemblies and any consequences in terms of the integrity of the first barrier.
- Each loading sequence is therefore unique and valid, whether the fuel assembly's specific deformations.

Increase availability

- The length of time required for loading each assembly becomes disassociated from the assembly's geometrical characteristics.



## 5.6. COMPUTER APPLICATIONS IMPORTANT TO SAFETY

**5.6(1) Issue:** Validation of local computer application important to safety is not monitored and reviewed systematically.

- Although SSI put importance on monitoring and reviewing risk analysis of computer application in the plant, verification and modification process of plant application important to safety is not monitored and reviewed systematically.
- For the local application important to safety, validation process such as verification and modification process are not defined in the plant wide documents.
- Form of 'CALCUL G' was slightly modified, but this modification was not documented and validated because of it was just a modification on form.

Without proper validation for the computer applications important to safety, miscalculation could impact on plant safety.

**Suggestion:** Consideration should be given to conducting a systematic review and monitoring on validation of local computer application, which is important to safety, to ensure that usage of computer application doesn't give adverse effect on the plant safety.

**Basis:** IAEA Safety Guide NS-G-1.1; Software for Computer Based Systems Important to Safety in NPPs, para 12.1-12.16.

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

The following actions have been implemented :

1. Updating of department procedure on « local computer application IN 26/DI 64 » including validation requirements (during creation and modification) and periodic controls of computers application important for safety.
2. Updating of safety risk assessments guide. The report of test validation is included in the risk assessment. This requirement is precised in this guide. The report template is included in the writing guide.
3. Updating of "sensitive" local and corporate application inventory, from a safety perspective.
4. Updating of risk assessments according to the department procedure and guide is scheduled. This actions plan will be completed in October 2007.
5. Official recognition of role played by risk assessment officers (employees appointed within departments, in charge of risk assessments), taking the form of a letter of instruction, which states their areas of responsibility,
6. Clarification of coordination formalities within the operational safety committee (COS), with strengthening of cross-functional aspects via the plant coordinator (GSI),
7. Implementation by the testing section of a security locking and protection system for IT functions, including sealed personal access codes, IT network structure and specific area access rights,

8. Use of a computerised scheduling tool (PRV) to automatically print out the yearly control plan of IT functions used by the testing section as this section uses 60% of the Excel spreadsheets deemed as being sensitive.
9. Use of a modification sheet within the testing section to undertake, accept and track changes to an IT function.

Progress is monitored by the site operational safety committee (COS).

This committee has approved the site governing procedure and closely monitors the progress of outstanding risk assessments (COS meeting of 26 May 2005, 28 July 2005, 15 September 2005 and 19 April 2006).

Considerable progress has been observed since the COS meeting of 15 September 2005, both in terms of risk assessment progress and general implementation of this initiative by the departments.

The COS has therefore decided to conduct risk assessment status checks on an annual basis. Any signs of a drift detected by the site coordinator may result in additional COS involvement.

In 2006, a progress status check was carried out on 19 April.

In the period between May 2005 and June 2006, the progress rate of completed risk assessments went from 57% to 93% (36% increase), as against approx. 11% a year since 2000 (57% of risk assessments completed between June 2000 and May 2005).

The suggestion issued by the OSART team in May 2005 helped the site to review its programme control process and make considerable progress.

All risks assessments must be completed by the end of 2006.

Given the quickly changing nature of information technology and systems, this expectation is an integral part of the site's long term modus operandi.

**IAEA Comments:**

Procedure, application guidelines and validation sheet have been created for software validation. However this has been done just recently and further action is planned for 2007.

**Conclusion:** Satisfactory progress to date.

## 6. OPERATING EXPERIENCE FEEDBACK

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

The management of Blayais NPP recognizes well the role and importance of the Operating Experience (OE) process. Aspects related to the OE programme are reflected in the plant Nuclear Safety and Radiation Protection Policy – one of six plant policies, described in the document D5150.N.Q2.DIR.0002.00.

As a result of this recognition, a comprehensive OE programme is in place. The programme is well described in the plant documentation. The latest change in the organizational structure of the plant, effective from 1<sup>st</sup> March 2005, has had a positive impact on the plant OE programme. As a result of the new organization, a simplified and better-controlled organization, more effective use of resources and more clearly and better defined responsibilities were achieved. The rather complex OE programme at the Blayais nuclear power plant covers all necessary and expected areas. However, the team recommended some improvements to achieve a more consistent and integral treatment approach for the whole range of events especially to low-level events.

Necessary tools and resources are sufficiently provided for the OE programme at the plant. Individuals managing the process along with working groups and committees involved are clearly identified. Duties and responsibilities are clearly described in plant documentation and well understood by plant personnel.

During interviews, the team found that a “blame free policy” is part of the culture, which is probably the best possible stage for its implementation. The team found that operators and other plant personnel are fully free to report their own human failures in case of events, in order to correctly identify and address the real cause of the event.

### 6.2. REPORTING OF OPERATING EXPERIENCE

An open reporting environment is very well established in the plant and communicated to the personnel via plant documentation and plant booklets. All plant staff and contractors are encouraged to report identified events, defects or any other deficiencies. Interviews with various individuals in the plant confirmed that they are aware of this expectation.

The team recognized that there are several different ways to report identified deficiencies in the field. The plant efficiently uses several EDF corporate databases and applications to report and to handle equipment defects and events. Recently the plant has put a lot of effort into improving its reporting and monitoring tools and reporting environment in the area of low-level events and near misses.

These improvements significantly helped to increase the number of identified and reported items. However, the team recognized the continuing lack of sensitivity to some low-level defects and near misses and suggested further improvements in this area.

The newly introduced VHC database is an effective tool to monitor all records from management field tours. Another form must be filled in for each record to ensure the defect is corrected. Plant personnel must know to which database what kind of deficiency must be

addressed (either PTJ or SYGMA, see chapter 6.8). Interviews with plant personnel show quite a good understanding of established reporting rules, however some confusion about a few specific items (e.g. door locks) can occur.

The team encourages the plant to further simplify the reporting process. The best international practice is that a reporting system should be very simple, user friendly, easy to follow and funneled into one single point for easy monitoring and trending.

### 6.3. SOURCES OF OPERATING EXPERIENCE

EDF corporate plays a significant role in distributing OE information from various known domestic and international sources. The operating experience monitoring group (GVR) corporate group of CAPE throughout the whole EDF fleet distributes this information via so called interdepartmental consultation (CID) sheets.

The plant has established a process for comprehensive review incoming external OE information. A regular weekly plant operating experience (COMREX) committee meeting screens and reviews all incoming CID reports at the plant level. In addition, the Fast OE sheets (RER) containing quick first level information on important issues from other French plants are discussed. COMREX meetings are conducted in a professional manner. Various aspects, though mainly the technical aspects of lessons learned and the potential impact to Blayais NPP from external events are assessed. If necessary, responsible departments are assigned for implementation of corrective actions. Most of the plant personnel have direct access to the CID database via the computer network.

The contribution of the Blayais NPP event reports to IAEA, WANO and other nuclear industry event databases is in line with the EDF corporate guidelines, which has been significantly improved in last three-year period.

### 6.4. SCREENING OF OPERATING EXPERIENCE INFORMATION

All reported events at the plant are appropriately screened for significance on a daily basis. A well-structured set of criteria for reporting of safety significant events, radiation protection events, events with environmental impact or transport events to the national regulatory authority is included in EDF corporate directives (DI 19, DI30, DI100, DI55, DI103). Screening is carried-out by personnel with a sufficient knowledge and experience of plant operations.

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

A six-month follow-up review process of all FRA sheets is established to ensure the quality of reported events and to make sure that personnel understand the risk involved in safety consequences. The plant introduced a specific performance indicator to monitor the time limits for the development of fast-track analysis sheets (FRA) and for informing the regulator. The team recognised the use of fast-track analysis sheets as good practice.

## 6.5. ANALYSIS

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

Very comprehensive event reports including the development of corrective actions are elaborated in each particular case. There is a 60 day time limit to prepare the final report and inform the regulatory authority, which is adequate. The specific performance indicator is introduced at the plant to monitor this limit. However, only about 40% of reports are carried out within this time limit. Most of the remaining 60% have a few days' delay. The team encourages the plant to improve this area.

The plant has different well-developed tools for handling technical problems according to their complexity – technical analyses (engineering opinion sheets in GTL database) or equipment and function summary reports. More serious issues are dealt with in plant projects.

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

The human factor specialist is a member of the investigation group, in case if any human factor involvement was identified during the event. The team found that she had a very good understanding of the importance of low-level events and of the near-miss concept as a tool for identifying significant events precursors. There is an action plan developed to integrate the human factor analysis into all available OE information in the future. However, currently the plant personnel are mostly focused on the technical aspects of events (especially for low-level events and near misses) rather than human factor aspects and human behavior failures. The team encourages the plant to put more effort into improving this area.

## 6.6. CORRECTIVE ACTIONS

An investigation group in close cooperation with plant departments develops corrective actions to eliminate the root causes of significant events and prevent their reoccurrence. Development of corrective actions is done within the time limit for the final report preparation process – see chapter 6.5. Developed corrective actions are validated and approved at the appropriate plant management levels. The plant recognises three levels of corrective actions used for significant events: information, monitoring/action implementation and the most important type of corrective action, so called commitment.

Specific plant departments are assigned for corrective actions implementation. Clear implementation deadlines are set at the plant and regularly monitored closely and tracked via a corporate electronic database. Very good timeliness of implementation is achieved – 91% of 66 monitoring/action implementations completed in time, neither of two commitments were delayed.

Effectiveness of corrective actions is regularly assessed and monitored.

## 6.7. USE OF OPERATING EXPERIENCE

External OE information is regularly provided to the plant by EDF corporate (CAPE) and the plant has strong support from the corporate in this area. Most of the recent major events in the worldwide nuclear industry are included in these reports. In addition, the plant personnel have direct access to WANO Paris Centre database. The team found that personnel from the logistics department, which deal with fuel handling, is aware of the details of the Paks NPP (Hungary) event.

In-house and corporate results of OE information analysis are used effectively to improve the simulator training programmes. In the year 2005 five new scenarios were implemented into plant simulator lectures, three of them as corporate and two as in-house requests.

Several electronic databases with various corporate and plant OE information are available and accessible to the appropriate plant personnel via the computer network. Generally, the plant personnel have adequate knowledge of external OE information. However, during the interview with main control room operators the team found that they have extremely limited knowledge of recent Mihama NPP (Japan) or Paks NPP events. In the same time, the operators were aware of the electronic database with external event reports (CID), but were not able to identify it in the intranet network. The team encourages the plant to make improvements in this area.

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

The team found that very good preparation of just-in-time OE information focused on pre-job briefings of outage personnel during the outages. The safety engineer does the screening of relevant external OE information and links these reports to scheduled daily outage activities. The team recognized this as a good practice.

The Blayais plant is overseeing the so-called INDEX project. The goal of this project is to share knowledge and good practices in the engineering area and to reach an overall improvement of plant performance by providing an effective tool via the corporate intranet network. All nineteen nuclear sites are involved and associated with this project. The team recognised the INDEX application as a good practice.

## 6.8. DATA BASE AND TRENDING OF OPERATING EXPERIENCE

The plant uses a number of different databases to record and track the various kinds of event reports. Some of them as SYGMA, SAPHIR, PRISME, ARCHE are operated at national EDF corporate level others are developed at plant level (FIMODO, GTL, PTJ, etc.). The plant departments use their own databases (FAST, DT, etc.) to track requests on procedure modifications, industrial safety issues, near misses and other issues related to their departments. Most of these databases use sophisticated up-to-date electronic and software tools.

Modern and powerful electronic databases were recently introduced. The PTJ database is devoted to the handling of small housekeeping and cleanliness jobs.

The VHC database is a very good, effective and flexible tool for monitoring and trending low-level events and near misses recorded during the management field tours. It enables the trending of data by using various criteria and the identification of generic deficiencies of the plant. In addition it is a very efficient tool for promoting plant management tours in the field and for monitoring their effectiveness. The team recognized the implementation of this tool as good performance.

Trend analysis of significant events and low-level events recorded in the PTJ and VHC database is regularly carried out and results of these analyses are reported to plant management.

## 6.9. ASSESSMENT AND INDICATORS OF OPERATING EXPERIENCE

Regular self-assessments of the OE programme as part of internal reviews of the technical support processes are done twice a year. The last review was carried-out in October 2004 and results were effectively used to improve the OE programme during the plant reorganisation in March 2005. Therefore the main achievements of the new organisation are considered to be:

- A more simple and clear structure with better defined responsibilities for all involved groups and individuals
- The integration of all units and plant facilities into one compact OE process
- The more effective use of resources

However, further integration of the plant's operating experience programme, as described in chapter 6.1, is desirable.

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

### **BLAYAIS NPP FOLLOW-UP SELF ASSESSMENT**

The site has made full use of the positive and negative findings as well as the advice issued by the OSART team in order to improve both its OE structure and efficiency. In addition, we took advantage of changes in site organisational structure to clarify and standardise our modus operandi. The main organisational and cultural changes relate to the following points :

- As part of the process-based management system, OE is managed by the associate director for technical matters who uses indicators to gauge its efficiency,
- OE processing methods used by the various departments have been clarified and standardised,
- OE collation and analysis tools are common to the whole plant,
- A low-level event data collection and analysis system, in line with IAEA standards, has been implemented and is being used by plant departments and senior management,

- The site was already aware of the importance of human performance analysis when it came to identifying event causes. Human performance analysis has now been extended to include low-level events,
- Staff have been briefed on the near-miss concept, which was unfamiliar to the site at the time of the review. The benefits of this approach for enhancing operational safety have been emphasised. The system used to collect near-miss data is very user-friendly and is accessible to all staff.

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

In summary, the team concluded that the plant developed two good tools in addressing the issues in the OE area. One is for reporting the LLE and NM (LLE/NM) and the other is for the event, which is decided by the manager to be analysed (REX).

As the database LLE/NM is used by all level of the plant personnel, it is designed as quite user friendly. Human factor related event can be easily distinguished. The responsibility of inputting, classification, decision of corrective action, feedback, trend analysis and monitoring is defined and human factor coordinator is involved.

The database-REX is also well designed and user friendly. Between two databases, classification of the LLE and NM is unified and reporting part can be linked.

Based on these data, the department level and the plant level trend analysis are planned every six months.

Although both databases are in operation, LLE/NM database is not officially in force and currently only 30 LLE and NM were reported by the staff.

The leaflet on this database was distributed to all plant personnel and presentation to the head of each department was made, however, explanation to the staff was not conducted systematically and its deadline was not settled. The action plan to involve the whole plant personnel is considered by using human performance coordinator but the plant still needs time to develop a concrete action.



## DETAILED OPERATING EXPERIENCE FINDINGS

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

**6.1(1) Issue:** The plant does not apply a fully consistent and integral approach to all-available internal OE information for comprehensive summary reviews to identify the generic issues. The team observed the following facts during the review:

- The plant’s OE programme covers all necessary areas of the feedback process. However it is a rather complex system of responsible plant individuals, bodies, databases and links amongst them.
- Significant reportable events recorded in SAPHIR database and inputs recorded in VHC database are properly handled. However, a part of the middle of the ‘event pyramid’ does not receive appropriate OE treatment. The plant workers and contractors are instructed to report identified defects and deficiencies through their work site supervisors by filling-in the observation sheet. However, these reports are processed directly for corrections and are not considered for the plant summary trending.
- The various plant departments manage their own databases of reported problems and human behavior issues. However, there is a limited and not fully systematic review process of these departmental issues from the ‘upper level’ of the plant OE organization. There is no clear evidence that departmental records are included in the overall plant trending process.
- The plant human factor specialist is involved in investigations of all events treated via fast analysis sheets if a human factor was involved. However, in cases of low-level events and near misses reported into departmental databases the plant is currently much more focused on the review of technical aspects than of human behavior issues.

Without applying an integral approach to all the available plant operating experience information the plant is losing opportunities for early identification of overall trends and generic issues which could have impact on safety.

**Recommendation:** The plant should apply a fully consistent and integral approach to all-available internal OE information for comprehensive summary reviews to identify plant generic issues in order to prevent significant events or their reoccurrence.

**Basis:** IAEA Safety Standard no. NS-G-2.4, para 6.64, 66, 68; PROSPER Guidelines.

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

In order to address this recommendation, we have focused on two closely related areas :

- Processing of low-level events and near-misses, addressed by the OE suggestion,
- Department OE structures and pooling of analyses.

The OSART mission, combined with changes in site organisational structure, provided the opportunity to review department practices in the area of. This review was conducted by a

working group consisting of department OE representatives. The findings of the working group were submitted to the technical committee, who approved the proposed decisions :

- Discussion of OE challenges and benefits of pooling data,
- Creation of a single database for pooling together OE analyses conducted by departments. This database replaces individual department databases. Existing data has been retrieved. Analyses are categorised in the same way for low-level events and major events,
- Standardisation of practices in order to make OE data processing more efficient. This initiative focused on the processing of OE data pertaining to equipment-related deficiencies (DI 55 and DI 103). This information is stored in a database which is common to all EDF plants.

Thanks to these initiatives and those implemented in response to suggestion no. 6.2(1), the site now has a integral set of databases for keeping a record of major and low-level events. Site senior management periodically uses all this data for trending purposes, the aim of which is to identify precursors and thus avert more serious events.

#### **IAEA Comments:**

The databases which deal with LLE and NM were reorganized and as a result 2 databases were developed. One is for reporting the LLE and NM (LLE/NM) and the other is for the event which is decided by the manager to be analysed (REX).

As the database LLE/NM is used by all level of the plant personnel, it is designed as quite user friendly. The input display is simple and LLE and NM could be easily distinguished. Human factor related event can be easily distinguished also. The responsibility of inputting, classification, decision of corrective action, feedback, trend analysis and monitoring is defined and human factor coordinator is involved.

REX is also well designed and user friendly. Between two databases, classification of the LLE and NM is unified and reporting part can be linked.

Based on these data, the department level and the plant level trend analysis are planned every six months.

Although both databases are in operation, LLE/NM database is not officially in force and currently only 30 LLE and NM were reported by the staff. The leaflet on this database was distributed to all plant personnel and presentation to the head of each department was made, however, explanation to the staff was not conducted systematically and its deadline was not settled. Follow-up of staff awareness is not planned.

**Conclusion:** Satisfactory progress to date

## 6.2. REPORTING OF OPERATING EXPERIENCE

**6.2(1) Issue:** The plant expectations on near miss reporting are not sufficiently communicated to the plant personnel and not fully implemented in the field. The team observed the following facts:

- The plant policy on safety D.5154.N.Q2.PR.60110.00 in principles number 4 and 5 encourages the whole plant personnel and contractors to report low-level events and near misses.
- During observation in the main control room one plant staff member working in the control room tripped-up three times within a 30 minute period on the same floor tripping hazard point. When asked whether he will report this, he answered that probably no. He was not sure where to report this kind of event.
- During the interview with the shift supervisor, the team found that near misses are rarely reported.

Without clear communication and full implementation of expectations on the reporting of near misses the plant could lose a number of opportunities to learn lessons from near miss events and to develop effective safety measures to prevent events with serious consequences.

**Suggestion:** The plant management should consider communicating more efficiently with all plant personnel and fully implementing in the field the expectations on reporting of near misses.

**Basis:** IAEA Safety Standard Series no. NS-R-2, para 2.24; NS-G-2.4, para 6.64, 68.

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

The site has drawn on best international practices not only in response to this suggestion, but also in order to implement a holistic and exhaustive approach to processing data which could help to identify low-level events.

Our approach is based on the following :

- IAEA document TECDOC-1477 dated November 2005: Improving operational safety through the use of trend analysis for low-level events and near-misses,
- Plant operators OE workshop (WANO workshop held in January 2006),
- Investigations underway at corporate level for the long-term implementation of our strategies.

The low-level event programme was put together by a group consisting of department senior management, the senior plant advisor on safety/quality and the human performance consultant.

The working group's proposals were approved by the safety technical committee on 23/02/06 and implemented on 01/06/2006 :

- Data used to detect low-level events is based on field inspections conducted by managers and on direct worker feedback (on-the-spot observations). Use of the "field inspection"

database, previously confined to managers conducting field inspections, has now been extended to include all staff.

It is now called the “field observations and low-level events” database. (Note that the OSART reviewers had identified the use of this tool as a good performance).

- Access for non-managerial staff has been simplified in order to encourage feedback (on-the-spot observations),
- Near-misses are clearly identified, as well as observations with a human performance component, in order to facilitate analysis,
- New screening criteria have been defined. They are common to the whole plant and are applied for all OE data: major events (SSE), craft analysis (see response to recommendation), low-level events,
- The process for dealing with on-the-spot observations consists of three phases :
  - Immediate analysis by the worker’s line management in order to categorise the observation, define a course of action and promptly respond to the person who reported it,
  - Six-monthly department trend analysis,
  - Six-monthly site trend analysis, conducted by a human performance consultant and approved by the safety technical committee.
- All levels of staff have been duly briefed on implementation of the programme :
  - Extended senior management committee,
  - Managers, on the occasion of department senior management meetings,
  - Workers (Plant letter).

On these occasions, we explain the meaning and safety implications of a near-miss, and encourage workers to report them.

In order to ensure long-term results, “the low level events and near misses” process is included in the “human performance” plant project. To improve the project’s performance, department representatives have been appointed. Performance indicators have been finalised and are monitored by the Safety Technical Committee (GTS).

Although the programme has been rolled out only recently, the team effort has helped us to understand and assimilate the aims of a low-level event programme, as well as the “near-miss” concept. Since the summer of 2006, departments have thus been able to extend the scope of observations made on the occasion of field inspections and to start performing database analyses.

This process is included in the “human performance” plant project, which ensures its sustainability.

**IAEA Comments:**

The database which deals with NM reporting together with LLE was developed. As this database is used by all level of the plant personnel, it is designed as quite user friendly. The input display is simple and LLE and NM could be easily distinguished. Human factor related event can be easily distinguished also. The responsibility of inputting, classification, decision of corrective action, feedback, trend analysis and monitoring is defined and human factor coordinator is involved. (see 6.1(1))

Based on these data together with REX data, the department level and the plant level trend analysis are planned every six months.

However, this database is not officially in force and currently only 30 LLE and NM were reported by the staff. The leaflet on this database was distributed to all plant personnel and presentation to the head of each department was made, however, explanation to the staff was not conducted systematically and its deadline was not settled. Follow-up of staff awareness is not planned. The plant management well recognized the difficulty of involving the plant staff. The action plan to involve the whole plant personnel was considered by using human performance coordinator but not clearly established yet.

**Conclusion:** Satisfactory progress to date

## 6.4. SCREENING OF OPERATING EXPERIENCE INFORMATION

**6.4(a) Good practice:** The fast-track analysis sheet (FRA) is used by Blayais NPP to consolidate the event-reporting process: it is created prior to the faxed significant event report. This helps to improve the safety-significant event reporting process and to extend it to the areas of radiation protection, the environment and transportation.

As soon as a deviation from DI100 is suspected in any event involving the areas of nuclear safety, radiation protection, the environment and transportation, a fast-track analysis sheet is created. Its purpose is to:

- Establish and validate facts between the safety/quality department or environment department and the craft concerned,
- Conduct two comparative and independent analyses, one by the safety/quality department or environment department, and the other by the craft concerned,
- Convene an extraordinary meeting chaired by senior management in the event of disagreement between the safety/quality department or environment department and the craft concerned.
- Manage the delay of event declaration to the safety authority.

FRA conclusions may give rise to an OE report, a SAPHIR report, a local event report or a significant operating event report. All fast-track analysis sheets are stored in a Lotus Notes database, where all staff members can read them.

In addition, a 2<sup>nd</sup>-level analysis is conducted every six months in order to check:

- the effectiveness of the reporting process for deviations or situations which could affect safety.
- the effectiveness of the lines of defense (shift manager, safety engineer) and associated processes related to reporting of deviations in terms of requirements.
- staff understanding of safety goals.

The review by the plant safety review committee (the plants highest nuclear safety decision making body) of this analysis every six months helps guarantee deviation reporting compliance, as well as developing a safety culture.

Advantages:

- Comparative, documented and independent analyses conducted by the safety quality/environment departments and the relevant craft,
- Same process for the areas of nuclear safety, radiation protection, environment and transportation.
- Senior management decisions documented and expounded upon in the event of disagreement; distribution to all members of extended senior management committee.

- Second-level analysis conducted every six months in order to ascertain the relevance of decisions, with possible amendments after validation by technical safety committee (GTS).

Supporting qualitative and quantitative information:

- The FRA process is an original practice of Blayais NPP. It is recognized as an effective safety management tool at corporate level and has been put forward to other French NPPs.
- The process has been used for several months in the areas of nuclear safety, radiation protection, the environment and transportation. The indicators show an improvement in the delay of declaration of safety events.

## 6.7. USE OF OPERATING EXPERIENCE

**6.7(a) Good practice:** Preparation of just-in-time OE information for plant staff pre-job briefings during the outage. At the beginning of every outage meeting, a safety update is provided by the outage safety engineer. On this occasion, a document is handed out and presented to all participants. This document lists the activities of the 3-day schedule (title and code) where nuclear safety risks have been identified. It also specifies which craft will be performing the activity. Each activity where risks have been identified is directly linked to:

- Operating experience feedback, particularly from safety significant events occurred on other EDF plants,
- Safety expectations
- Traps, which should be avoided.

The document is also distributed to shift teams and discussed at the start-of-shift briefing. Useful OE information for future activities is presented (in order to prevent errors from recurring events). Craft attention is focused on risks associated with their activities. Risks are illustrated using concrete examples. Expectations for each activity are restated. Crafts are provided with a document that they can then discuss with their teams.

**6.7(b) Good practice:** INDEX is a user-friendly and efficient computer network application that links together the various engineering crafts within the whole fleet of nuclear power plants at EDF. It is based on the internal intranet system. The network structure linking the 19 nuclear power plants (58 reactor units) is an effective means of disseminating operating experience and of meeting two specific goals forming part of the strategy developed by the corporate nuclear operations division:

- Striving to improve performance and sharing of good practices,
- Sharing of knowledge.

Blayais NPP is overseeing the INDEX project, with a view to implementing participative working methods between French nuclear plants, with most of the nineteen plants involved in and associated with the project.

The INDEX information system, intended for use by plant engineering entities (FIL), i.e. all engineers and planners working for the nuclear operations division, is more than a simple communication tool. It provides engineers with a service, by grouping together all products and tools need by them on a day-to-day basis:

- A full-fledged directory of engineering skills (Who does what?)
- A set of OE databases, supplemented with data on their content and compilation,
- A networked forum that integrates the activities of NPP engineers.

Easy to use thanks to its “full text” search engine, engineers can retrieve information and technical analyses from a pool of operating experience obtained from 58 reactors, thereby enabling them to enhance efficiency and performance.



This network structure, divided up into crafts or specific areas (reactor series or functions, for instance), complements the nuclear fleet's existing system. The network provides a daily link-up with NPP engineering entities, thus enabling engineers to mutually identify areas for improved performance. Because the network is run by peers, plant-specific issues can be discussed, such as optimised maintenance as well as sharing, development, promotion and implementation of good practices.

The INDEX intranet site has been up and running since 15 January 2005. Its web address is <http://intranuc-index.edf.fr>. This site groups together the main technical OE databases of the EDF nuclear operations division. One of them is used to collate "position sheets" from the 19 NPPs and corporate entities, amounting to more than 8500 documents.

The networks dedicated to "valves", "main generators", "ventilation systems", "1300-MW plant operation" and "IEC" are up and running. The skills directory, currently being compiled, has 2500 entries. A set of comparative key performance indicators is used to monitor participation of the 19 NPPs.

## 7. RADIATION PROTECTION

### 7.1. ORGANIZATION AND FUNCTIONS

The structure of the RP programme including dosimetry monitoring and record keeping, control of access to the RCA, the ALARA program, systematic surveys, meet international standards. It is the active integration of the industrial risk minimization with the RP programme that work together to make each stronger and promote a robust safety culture. The team considers this integration of risks a good performance. The RP programme has established appropriate administrative limits, policies, goals, objectives and performance indicators. Responsibilities and authorities are defined and well understood by all supervisory levels. The principles of ALARA are well established.

Radiological dosimetry is reviewed daily or weekly, depending on the status of the plant. Events are reported promptly, as prescribed by procedure. Management levels of supervision conduct ongoing reviews of the programme daily and the ALARA aspects take into account the work tasks, input from other plant departments, and the total risks of industrial hazards and radiation risks. The dosimetry database contains detailed entries enabling the association of doses and specific jobs, and specialty crafts. This system of dosimetry record keeping is outstanding and enables the daily review of performance indicators during outages and weekly review during normal operations.

The independence and authority of the RP group is adequate. There is an appropriate level of dependence upon the corporate level RP on generic radiation protection matters.

Senior RP manager's inputs are used in the elaboration of operational procedures addressing radiological issues. The management approach and the policy principles supporting RP at Blayais are a programmatic strength and team considers a good performance. The initiative to work directly with contractors to minimize both industrial and radiation risks is an example of the importance of the management approach and policy principles. The RP group's performance is periodically evaluated with in the group, at the senior management level, with QC from outside the group, and at the corporate level.

At corresponding levels, with operations and maintenance groups, coordination is an ongoing activity. The level of planning is in keeping with the level of hazards as indicated by the dose rate in the work area. Activity in the highest hazard area requires the signature of the plant manager or his designee. ALARA considerations are part of the planning. The organization and supervision of contractors parallels that of the plant organization, and supervision is conducted through interactions at the corresponding levels.

The qualification of personnel is accomplished through prescribed levels of formal training commensurate with the work and with written testing. Certified trainers train contractors, and the certification is given by the Ministry of Labour. Procedures prescribe the level of qualification and experience appropriate for the assigned tasks. On special tasks, such as steam-generator work, mock –ups and rehearsals are used. RP training programmes are relevant and at the appropriate level to the duties and responsibilities of the workers.

Health screening is a prerequisite for access control to radiation control areas. The plant has an on-site medical facility staffed with a doctor and several nurses. The plant medical staff provides to plant employees entry health screening, clinical examinations, accident health

care, treatment for sickness, and complementary medical care for radiation risks as well as for other industrial risks. They also provide clinical examinations and complementary examinations for contractors. They provide approximately 2400 annual clinical examinations and 12000 whole body counts per year. The contractor's employer is required to provide entry screening examinations for contractors. The protocols for entry examinations of both the plant and the contractor are the same. The corporation, at the national level, could increase its awareness of colour-vision deficiencies in a fraction of its workforce, and investigate the potential significance of them in jobs that rely on colour coding for important information.

In the event of a relatively large internal intake of radionuclide(s), the medical staff has the discretionary authority to increase the number of urine or fecal samples prescribed by procedure to more accurately assess the dose. With the approval of plant management with the recommendation of the plant doctor, medicines may be administered to reduce the dose from an intake. Stable iodine is routinely stored outside containment for blocking the uptake of radioiodine, in the case that there is an exposure to radioiodine. Management of radionuclide intakes are based on onsite whole-body counts. Assay of biological samples are coordinated and assayed by the corporate laboratory. The medical surveillance is periodic and scheduled. In addition, the medical team is available to the workers on a "as requested" basis.

## 7.2. RADIATION WORK CONTROL

In situation where a few tens of micro-Sieverts or greater, are possible exposures, work is planned. Routine work such as packaging very low-level waste is generically planned in the development of the applicable procedures.

The radiation work permit (RWP) programme records pertinent to cover the details of the job and is working effectively to record the needed information. The procedures are more than adequate and are followed in the majority of the cases.

Special provisions are made for unusual risks. A full ALARA analysis is performed when the work to be performed could result in doses that are likely to be a significant fraction of or comparable to administrative limits. The team identified a good practice: a central display panel and large, flashing amber light at the plant's main access entry post informs personnel entering the plant that radiographic shots are in progress and provides notice of their exact locations.

The physical layout of all RCA access points is adequate. The physical spaces available are generally adequate with ample lockers, room to issue, put on, and return the protective clothes. The ergonomics of the change room procedures exiting the RCA is somewhat cumbersome and the space is restricted. The plant recognizes the need for improvement and has plans in place to do so.

The plant provides an adequate number of hand-held and console personnel monitors. They are available at RCA entry points and key administrative offices. Active electronic dosimeters are ample in number and provided and register dose in real-time. Neutron polymer-bubble dosimeters provide neutron dosimetry in the field.

The system of postings is colour-coded and covers the entire range of dose rates above 7.5  $\mu\text{Sv/h}$ . Specifically there are five colour-coded trifoils for radiation control zones. Green is for the dose rate range of 7.5  $\mu\text{Sv/h}$  to 25  $\mu\text{Sv/h}$ ; yellow is for 25  $\mu\text{Sv/h}$  to 2000  $\mu\text{Sv/h}$ ;

orange is for 2 mSv/h to 100 mSv/h and red is for greater than 100 mSv/h. The fifth colour-coded trifoil is for another kind of zone; it is blue and is for surveys of personnel, materials and equipment. In this latter zone, the annual dose could be from 1 to 6 mSv. When the area is contaminated, the white background is stippled, that is filled with black dots.

While the control of radiological areas and individual work sites in the majority of areas is generally adequate, deviations were observed

The team has recommended RP technicians, EDF, and contractor work teams should always implement consistently all RP standards required by the plant, and these RP technicians and work teams should always systematically and reliably reinforce all plant ALARA practices.

The survey programme is comprehensive, timely, and accurate. An RP technician was observed performing a scheduled monthly update of a yellow zone with orange zone hot spots effluent treatment area (location W213). The technician electronically recorded the survey, corresponding reference points, which were painted on the floor, measurements and smear results. ALARA practices were conducted effectively and efficiently by performing surveys and smears quickly then moving into a green zone to handle recording of data, storage of smears, marking updates on zone posting signs. During this survey an independent quality control team was conducting a weekly audit of the radiological status of the area.

The leak reduction programme is generally adequate to control leaks, but the implementation of this programme needs improvement. This evaluation is supported by observation mentioned in the Detailed Radiation Protection Findings.

Internal exposures are adequately controlled, and personnel contamination monitoring is adequate. Exposure assessments are thorough. As warranted, corrective actions are taken to keep exposures ALARA.

### 7.3. RADIATION DOSE CONTROL

ALARA principles are followed for all planning and execution of work. Consistent with these principles, there is a graded effort in their implementation. For example, common tasks are treated generically in ALARA applications in yellow and green zones. The ALARA program is a programmatic strength, because of its organization and structure and analyses incorporating all relevant departments and, in addition, iterating approaches as a specific job progresses. In the large majority of cases, ALARA principles are implemented in the execution of work, however, some uneven adherence to these principles was observed in the execution of work.

Work in orange and red zones is specifically analyzed for ALARA by a dedicated ALARA team.

There is a widespread motivation to apply and adhere to ALARA principles evident that extends beyond the RP group to other departments, including, maintenance, chemistry, plant modifications. They are active participants in the design of ALARA implementation. However, the adherence to these principles was observed to be strong at the management level in the areas of policy and planning but decreasing to lapses in adherence at the work level. This statement is supported by observations of inadequate posting and labeling of radiation control zones, potentially for spreading contamination, and lingering in a yellow zone in areas with relatively high exposure rates.

Supervisors and managers including the senior managers are active participants in the ALARA processes. The team recognized good performance in the ALARA planning for a major unit 4 outage. The plant optimised the projected collective dose by detailed integration of and planning by all departments involved.

The plant has worked to control and reduce source terms; keep control over worksites with radiation risk; and examine long-term actions. They enlisted detailed support from the staff of specialist crafts and from the corporation's most experienced persons in systems decontamination. They deployed active skills development and renewed skills training on an annual basis. They developed methods, including source term reduction with system cleaning, equipment, tools and techniques for improving in the various areas and bench marked with other nuclear power plants, partnerships and corporate support.

However, workers' use of good ALARA practices varies in their implementation, and needs improvement through consistent application.

A comparison of the effectiveness of the dose control programme is most objective when the comparison is made with plants of the same design. This is possible since there are a number of other plants in the same system. Evaluation of Blayais NPP effectiveness of dose control for individual doses, collective doses, and trending shows that this plant has been better than average for similar plants. In addition, in a broader comparison with the industry as a whole, Blayais NPP dose control compares favorably with the best international practices.

Workers have taken required training that includes the mechanics of contamination control measures; they implement protective clothing procedures, and are monitored by their supervisors and RP personnel. However, some workers were observed carrying a potentially contaminated and unwrapped pipe to a green zone area for monitoring. Coaching and reinforcement of the training could be needed on a continuing basis.

Procedures for whole body counting have been developed by the corporate office, as are the calibrations. These procedures are adequately implemented on a daily basis.

Instruction in the good practical factors on the use of protective equipment is a review by RP personnel that protective clothing underwear is required based on operating experience. In addition, use of the hand-held survey instruments is emphasized surveying the sides of the body where the stationary personnel monitors are less sensitive.

Air protection factors are considered, and the air sampling programme is adequate.

Intakes of radioactivity are assessed by whole body counting and urine analysis, where appropriate. The activity is converted to equivalent dose by using corporate procedures, which in turn, use ICRP methods in accordance with international standards.

Root cause evaluations are implemented for unusual exposures or situations.

Film badges are used for external dosimetry in accordance with international practices for beta-gamma exposure measurements. Neutron dosimetry is measured by bubble dosimetry in polymers. The film badges, while an adequate measurement method, could be updated with a modern dosimetry method such as thermoluminescent dosimetry. This update is planned for the plant. The update should provide improved accuracy, resolution, and efficient automation.

The plant's programme for routinely monitoring exposures is an area of good practice. Combined radiological work permit and dose forecast database facilitates detailed ALARA planning. Doses are entered into a database with detailed information associated with the exposures, such as the work permit, the department doing the work, and a running total dose for reporting periods. During outages, the doses are monitored routinely at daily intervals and weekly at other times. These doses are assessed in accordance with international standards. The well-implemented, formal dose assessment is effective, efficient, rapid, and provides complete tracking for employee and contractor exposures, and, thus, is an area of good performance.

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

Portable and fixed dose rate and contamination measurement instrumentation are adequate, and there is more than adequate inventory of measurement instrumentation that is well-located. Calibration facilities and quality control procedures are adequate and are performed off-site by certified contractors on a well-established schedule.

There are adequate facilities and equipment for internal contamination monitoring with equivalent dose checks consistent with international practices, and adequate QA control of equipment.

There is adequate control of effluent release paths with equipment properly calibrated and QA standards applied.

There is good equipment availability, and QA controls are in place.

There is adequate instrumentation and facilities for emergency situations, including a mobile detection and sampling laboratory and spectrometer for off-site measurements.

There is an adequate inventory of protective clothing (PC) and respiratory equipment, well written procedures implemented and understood on the use of PC and equipment, effective contamination cleaning facilities, and quality and adequacy of supplies as shielding, signs, ropes, stands, etc.

Laundry, storage and shower facilities are well maintained and there is a planned improvement. Temporary storage of radioactive waste, contaminated materials, equipment and tools is provided, and appropriate decontamination facilities are available and well maintained.

#### 7.5. RADIOACTIVE WASTE, MANAGEMENT AND DISCHARGES

The radioactive waste management programme generally is well-implemented. However, in some cases, in the work areas sacks of waste were not always placed promptly in the storage provided. For example, full sacks at the work area and entering the blue zone were not promptly stored. The goals and objectives are established to minimize solid waste, and improvement in waste minimization has been demonstrated. Storage and packaging of radioactive waste results has resulted in minimizing exposures. The team has identified a good practice for the development and implementation of containers for on-site handling of waste that helps to control contamination and reduces doses. The classification of radioactive waste is adequate.

Releases are kept within authorized limits. Goals and objectives implemented are based on ALARA standards, and procedures to control effluent releases are in place. Effluent release records are adequately maintained.

Instrumentation supports expected activity levels, and there is a well established environment monitoring programme.

## 7.6. RADIATION PROTECTION SUPPORT DURING EMERGENCIES

There are clearly understood procedures detailing responsibilities and assigning individuals with authority and naming individuals who could be candidates for exceptional exposures. There are appropriate procedures regarding maximum doses in emergencies are in place, and there is adequate equipment and supplies available to support emergencies.

### **BLAYAIS NPP FOLLOW-UP SELF ASSESSMENT**

In the area of radiation protection, the discussions that we held with our OSART reviewers provided us with the opportunity to compare our systems and practices with those of other nuclear power plants and thus re-examine the efficiency of our own systems and practices, as well as their implementation in the field.

This comparison led the reviewers to identify three good practices and issue one recommendation.

In response to the recommendation, an analysis was conducted and an action plan drawn up. This action plan was approved by the RP committee and monitored by the technical safety committee. In order for each worker to fulfil our RP expectations in the field, we initiated actions in four main areas: clarification of reference standards, guidance and coaching of workers, monitoring of implementation in the field and rectification of deficiencies.

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

During the follow-up visit one recommendation was found to be fully resolved. In response to the recommendation, the plant provided an analysis and an action plan was drawn up. Understandable reference standards have improved staff knowledge and have supported plant expectations. They deal with the following topics: radiation protection signage, exiting the RCA, radiological work permits, jobs with potential contamination risks in the RCA. For the reinforcement of all plant ALARA principles, the plant has provided an extensive training programme for radiation protection technicians as well as the other EDF workers in the plant and contractors. Ten significant sessions have been conducted on the topics of signage, risk assessment, radiological surveys, event reporting criteria and gamma radiography.

## DETAILED RADIATION PROTECTION FINDINGS

### 7.2. RADIATION WORK CONTROL

**7.2(1) Issue:** Radiation protection (RP) technicians, plant staff and contractor work teams do not always implement consistently all RP standards required by the plant, and therefore these RP technicians and work teams do not always systematically and reliably reinforce all plant ALARA practices.

Inadequate implementation of RP standards was generally observed as posting and labeling deficiencies or lapses of attention to detail by trained individuals. Examples of this issue include the observations listed below.

Green zones generally are not marked, except at their entrance; rather they are expected to be assumed, even in the larger areas or corridors. Postings of zones are only at the change from one to another. Thus, if one passes from yellow to green there is not a posting to indicate that. The job supervisor carries a radiation rate meter for the details of the variations of radiation dose rate. At the entrance of the RCA there is a green zone posting, but no others were noted.

Each map in the entire collection of maps of radiation zones in Units 3 and 4 outside the RP control desk does not have an effective date; rather each has a notation that they are currently being updated.

At location NA234, there was a shielded work area with inconsistent indicators of the dose rates on two of the tags with yellow trifolios and illegible dose rate marking on one of those. At the Unit 1 charging pump area posting of a yellow zone dose rate was smeared and illegible. In this same area, the dose rate on an orange hot spot was not dated. A work area in Unit 1 refueling floor was posted indicating contamination, but the level of the contamination was not indicated. There was no yellow zone posting at K256, an area where modifications of the fuel pool were conducted in Unit 1.

There were boron leakages in several rooms and none was tagged to indicate that it was identified and a repair order had been made. It is unclear whether these leaks were potentially contaminated.

Posting of hot spots in the RCA are generally small and visually difficult to notice. Plastic radiation protection ribbon, which provides clear visibility and notice to the smaller posting with its details, was found at only two of these hot spots.

A leaking pipe was found with a leaky bucket and rags collecting the fluid; it was not marked and the area was not isolated. The liquid was leaking onto an area that was posted as contaminated, thus the overflow was likely spreading contamination.

The following observations were more closely aligned with the implementation of ALARA at the level of the workers.

No posting of an ALARA waiting area within a yellow zone work area was noted in the RCA. EDF employees, on two different occasions were observed lingering to talk in a yellow zone where a green zone was nearby.

A pipe which had its ends covered with tape was carried by contractors from a contaminated yellow zone to a green zone monitoring area unwrapped. It was set on the floor in the green area and checked for contamination with by a hand-held survey



meter and was wiped and the wipe was checked for contamination with the same meter.

A contractor was interviewed on his understanding of the risks of radiation, the specific radiation risks of his work on the fuel pool modifications, and dose limits applicable to him as an individual. He did not recall the annual dose limit or the individual dose limit for the work permit. He stated that his monthly dose limit is 2 mSv. He also stated that the risks from internal contamination were of the most concern.

A pink sack for waste was used to store shoe covers at the entrance of the yellow zone work area for fuel pool modifications.

Adhesive sheets on the floor between the RCA and clean areas should be wider. They could be stepped over and also because contamination from the RCA removed by the shoes with these sheets is likely to be removed with the first steps onto the sheets. Wider sheets could improve control of the spread of contamination on the shoes to the clean area.

Without consistent implementation and reinforcement of all ALARA standards, individual and collective doses could be higher than ALARA and the promotion of a good RP safety culture could be less effective.

**Recommendation:** Radiation protection technicians, plant staff and contractor work teams should always implement consistently all RP standards required by the plant, and these RP technicians and work teams should always systematically and reliably reinforce all plant ALARA practices.

**Basis:** IAEA Safety Standards NS-R-2, para 8.1, Safety Culture Indicators in INSAG 4 and 13.

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

In order to raise the awareness of EDF staff and contractors to our expectations in the area of radiation protection, the following actions have been undertaken :

Clarification of reference standards: RP procedures and other documents aimed at raising awareness in the area of industrial safety were made available to all staff in the risk prevention department's database in LOTUS NOTES format.

Additionally, in order to improve staff knowledge of reference standards in the field, four summary sheets setting out our fundamental expectations were drawn up by the RP department and made available to the crafts. They deal with the following topics : RP signage, exiting the RCA, radiological work permits (RTR), jobs with potential contamination risks in the RCA.

### Guidance and coaching on reference standards and expectations

Meetings have been held with the crafts in order to discuss reference standards and raise staff awareness to the following topics : Gamma radiography, orange-classified areas and radiological work permits.

The new RP information system (called 'SIRP') was installed at the beginning of the year, providing an opportunity to review our expectations in this area, in particular on the occasion of training provided in the use of the PREVAIR computer application, a system designed to

create radiological work permits, which are divided into 4 categories depending on radiation exposure or contamination levels. High-level radiological work permits, which are subject to approval by senior management, are an effective means of highlighting expectations as well as the importance attached to radiation protection.

Meetings have been held between plant senior management and senior managers from contractor companies in order to identify common areas for improvement, which are monitored over time. Meetings have been held with the 11 biggest companies.

A member of the RP senior management team participates in RP refresher training sessions. This is an effective means of clarifying expectations and placing them in context. In addition, a member of the site senior management team participates in training close-out sessions.

The GIE (group in charge of contractor coordination) has conducted 14 training/awareness sessions on various topics, one of which focused on work in the RCA.

A training programme for RP technicians has been drawn up and 10 sessions have been conducted since December 2005 on the topics of signage, risk assessment, radiological surveys, event reporting criteria and gamma radiography.

A morning was devoted to industrial safety matters, with the focus on radiological cleanliness.

#### Monitoring and processing of deficiencies

In order to improve performance and observational skills associated with field inspections carried out by managers (department inspection plans, management inspections, etc.), summary documents have been produced on the following topics : Orange-classified areas, radiological work permits, chemicals, asbestos, worksite housekeeping and jobsite close-out.

Deficiencies are systematically investigated, analyses are formally documented and resulting actions are monitored (RP-related events, significant RP events or C3 monitor alarms).

Monitoring of gamma radiography has been strengthened. Certain gamma radiography activities are systematically monitored by a member of the risk prevention department. Coaching provided by management to RP technicians has been stepped up : every Monday afternoon, at least one member of the department management team accompanies technicians as they perform their activities, together with a foreman. This provides an opportunity to observe field activities, discuss difficulties with workers, enforce expectations, monitor their implementation and help to deal with certain deficiencies.

#### **IAEA Comments:**

In response to the recommendation , the plant provided an analysis and an action plan was drawn up. This action plan was approved by the plant radiation protection committee and monitored by the technical safety committee. In order for each worker to fulfil radiation protection expectations in the field, the plant initiated actions in four main areas: clarification of reference standards, guidance and coaching of workers, monitoring of implementation in the field and rectification of deficiencies.

Understandable reference standards have improved staff knowledge and have supported plant expectations. They deal with the following topics: radiation protection signage, exiting the RCA, radiological work permits, jobs with potential contamination risks in the RCA. For the reinforcement of all plant ALARA principles, the plant has provided an extensive training programme for radiation protection technicians as well as the other EDF workers in the plant. Ten significant sessions have been conducted on the topics of signage, risk assessment, radiological surveys, event reporting criteria and gamma radiography.

Also radiation protection deficiencies are systematically investigated. In addition, the plant insists on training for contractors to improve their behaviour in the radiological area. There is evidence, among supply workmen, of very good knowledge of radiation protection safety issues as well as decreasing trends of effective collective dose and radiation spots.

**Conclusion:** Issue resolved.

**7.2(a) Good practice:** A central display panel and large, flashing amber light at the plant's main access entry post informs personnel entering the plant that radiographic shots are in progress and provides notice of their exact locations. This notification practice is formalized in a written procedure and is implemented within a short time of the radiographic shots. The team acknowledged that this is a good practice and should be brought to the attention of other plants.

The display of information related to radiography shots at the main access entrance is part of the process for preparing for the shots. This display is a means of providing information and communication used by the site to inform EDF and contractor personnel of the radiography shot schedule and its location, along with prohibited access maps during the shots. A large, flashing amber beacon ensures that attention is called to the notification.

This central display accompanied by the flashing beacon ensures:

- That a large number of persons entering the site, but not taking part in the radiography shots are informed. It should be pointed out that the main access post is the only access open during outside of normal working hours—the time when the great majority of radiographic shots are made.
- A rapid association between the presence of the flashing beacon and the ongoing radiographic shot.
- Direct visualization, by marking a map of the shot location and the areas of prohibited access.
- Rapid access to operational information on shots taking place, such as, shot operator pager number, countermeasures applied, radiological characteristics, and starting and finishing times.

**7.2(b) Good practice:** Combined radiological work permit and dose forecast database facilitates detailed ALARA planning. The team calls attention to other plants that the plant's organization of operational dosimetry and work activities in a readily accessible data base facilitates detailed and efficient ALARA planning.

The combined radiological work permit and dosimetry database forms an integral part of the planning process for jobs carried out in radiation exposure conditions. The information needed to describe a job and create a dose optimisation and monitoring document has been determined on the basis of RP reference standards. The radiological work permit issued by the computer programme ensures that all workers—employees and contractors—use a standard document that includes radiological data for all workers, including targets, and limits. It also specifies optimization measures. The database enables access to the list of craft representatives

within the area of radiation protection, a direct view of the processing status of the radiological work permits, quick access to specific requests for information on work permit information, access to common job planning databases, and the build-up of RP experience and feedback from activities.

## 7.5. RADIOACTIVE WASTE, MANAGEMENT AND DISCHARGES

- 7.5(a) Good practice:** Development of specialized shielding and enclosure for onsite transport of radioactive waste reduces collective dose and enhances contamination control. The team brings to the attention of other plants the development and implementation of radioactive waste containers for reduced collective dose and enhanced contamination control during on-site transportation.

The plant developed two types of containers for the on-site transportation of radioactive waste from the auxiliary building to the waste treatment and storage building. Sacks of low-level waste are stored in a stainless steel cabinet with tight-fitting doors and wheels for easy transport. Concrete shields that fit around waste containers for higher-level activity of waste are placed on trailers for towing to the waste treatment and storage building. The implementation of these has resulted in no spillage of waste, control of contamination, and reduction of doses during transport.

## 8. CHEMISTRY

### 8.1. ORGANIZATION AND FUNCTIONS

At Blayais NPP, activities associated with the areas of chemistry, radiochemistry and demineralized water production are performed by the Chemistry and Testing Department (ECE). The ECE department includes three sections - The Plant Chemistry Section, The Environment Chemistry Section and the Testing Section. Plant chemistry section includes monitoring of the 1st and 2nd barriers, the primary to secondary leaks, the primary system, the secondary system and auxiliary systems, monitoring the plants' physical, chemical and radiochemical parameters and optimise the quality and quantity of effluent generated.

The role of chemistry department is properly understood and strongly supported by the plant management. The chemistry staff have got all information about plant policy and are informed of their qualifications and understand their responsibilities. Main priorities of ECE department are safety and security, environment monitoring and rigorous operation.

The management of plant recognizes the important role of the departments related to chemistry and provides them the necessary support. Descriptions for every functional position in the department related to chemistry are available. Responsibility and authorities are clearly defined.

Appropriate chemistry performance indicators for chemical activities are established in accordance with the plant performance indicators and the chemistry staff is kept fully informed about them. Comprehensive system of chemistry performance indicators include 1<sup>st</sup> and 2<sup>nd</sup> leak tightness barrier and radioactive effluents performance indicators include releases of radioactive gases and liquids. Excellent knowledge of chemistry regimes of control room staff is confirmation of importance given to chemistry at the plant.

Assessments of the performance including self-assessments are carried out and reported to management. During the planning phase and depending on the type of activity, the risk assessments are documented in a work package or included in the laboratory procedure.

The chemistry department has internal interface with other departments within NPP and external interface with the following EDF entities- corporate laboratories (CEIDRE), environment group (GENV) and the fuel branch of the corporate engineering support (UNIFE/BC). These entities elaborate technical documents for chemistry department and also collect the results and communicate the experience feedback among plant.

The interface responsibilities and the corresponding flow of information to the operations and other departments are clearly described in the document "Organizations and management for the interfaces". ECE staff has regular daily communication with the control room operators. The communication is supported by SW system MERLIN and by cross – functional programme Lotus Notes. Comprehensive computerized information systems are effectively used for early notification of chemistry excursion allowing prompt response to mitigate potential negative consequences.

Effective response organization system exists in case of transgression of specified chemistry limits, which designate appropriate authorities for implementing corrective actions.

Training and qualification responsibilities are clearly defined in the training memorandum. Certain levels of authorization are prescribed for each hierarchical level. Each employee has his own individual training record. Shadow training for the new workers is performed and professionalism criteria are established in document: "Professionalism criteria for the lab". Training is sufficiently monitored by managers who detect required skills, lay out skill requirements, implement professional enhancement training. The job rotation within the workstations is conducted within of the laboratory branch.

All chemistry staff is knowledgeable of and effectively using current work practices, procedures and equipment.

## 8.2. CHEMISTRY CONTROL IN PLANT SYSTEMS

The plant established and implemented a comprehensive chemistry programme to ensure that chemistry is kept within specifications. Plant is operated with an optimal chemistry regime, which is largely determined by the design of the station, including materials of construction and the effectiveness of the water purification systems. The choice of materials defines water quality requirements and the design and dimension of the water treatment systems. However the team determined that chemistry programme with the specifications of corporate entity (CEIDRE), it is not completed enough to ensure proper quality water chemistry. The team has made a recommendation and an associated suggestion in this area.

The integrity of primary circuit components is adequately preserved by using the coordinated lithium/boron treatment with focus to maximum stability of pH(300) in accordance with current nuclear industry practices. Dose rate build-up is regularly measured by gamma spectrometry of isotopes of corrosion products.

The all-volatile treatment (AVT) is used, established by injection of hydrazine upstream of the turbine condensers. The feed water pH value is maintained at 9.6. Morpholine is injected downstream of the condenser extraction pump. Modified secondary chemistry of unit 1 was established, using the injection of boric acid, for improving the corrosion conditions of steam generators.

Procedures for shut-down and start-up are very well documented according to the different phases including technical and chemistry specifications.

Quality control system of lubricants, oils is performed by contractors based on procedures elaborated by CEIDRE. Procedures specify required values of significant parameters such as water content, insoluble particles concentration, total acidity index, viscosity. The quality control periodicity is well planed.

The makeup water system is operated to provide sufficient volume of demineralized water. The production of demineralized water produced is based on documentation "Operating guide for the production of the demineralized water". The quality of demineralized water at the demineralization water station is properly monitored by on-line measurements. Demineralized water is used as makeup water for technological systems of primary circuit and as conditioned water for secondary circuit. All the systems are cooled by conditioned demineralized water from point of view of safety systems of primary circuit. The demineralization station is very well maintained and managed by the chemistry department.

Considered replacements of plant equipment, modifications of procedures and processes are evaluated in taking into account the chemistry control aspects.

An effective radioactive waste minimization programme was established focused on the liquid effluents releases. Comprehensive programme to minimize the release of effluents into environment has been established due to proactive approach of plant management.

There has been a significant decrease of release of the liquid effluents by 40% in three years. The plant has established a commission for the effluents, which meets regularly and evaluates the trends of effluents. Moreover, the president of the commission using the trends establishes once a month the limit values not to be exceeded and establishes as well more restrictive limits for the release of the effluents in order to protect better the environment. The yearly limits established by the plant are set much lower than the national limits. Once a week there is a meeting between the departments to deal with the continuous production of the effluents and to deal with measures to take to decrease the production of effluents for the following week. Effective ALARA principles are properly adopted with respect to minimization of radioactive effluents to environment. This was recognized as good performance by the team.

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 in the case of deviation from the expected value but also in the case of small variation.

### 8.3. CHEMICAL SURVEILLANCE PROGRAMME

The chemical surveillance programme is based on a good and rational system of on-line monitors and grab samples. The sampling system appropriately covers all systems. The records from on-line analyzers are also very well registered in the control room.

When technical specification's limit values are exceeded, corrective action following chemistry results is timely taken. The course of corrective action implementation is recorded in written form, as well as in computerized form to keep better track of the deficiency and monitor its processing more closely.

Plant laboratories have set up a system of inter-laboratory comparison tests on the corporate level coordinated by CEIDRE for the chemistry and on national level coordinated by "Henry Becquerel" lab for the radiochemistry. The environmental laboratory participates in the intercomparison tests coordinated by IRSN (Institute of the Radiation Protection and Nuclear Safety).

The majority of the important chemistry parameters are monitored by adequate range of on-line monitors. Instruments are properly calibrated and cross-checked with other (portable) monitor readings, laboratory analysis or calculated data with adequate documentation. Maintenance and adjustment of all instruments is properly documented in both printed and computerized logbooks. Programme CAOLIN automatically recalculates the measured concentrations of feed water anions, and concentration of blow-down anions compared to cation conductivity. Also tritium method for leakage for primary and secondary is calculated by CAOLIN for monitoring of SG leaks. Standards from different suppliers are used for calibrations and check measurements to avoid errors. Analytical results have good traceability back to raw measurement data.



The comprehensive system of quality assurance of laboratory and continuous measurements was recognized as good practice by the team.

The results of chemical and radiochemical analysis are regularly checked by management of chemistry. There is a very effective system for tracking of trends of laboratory and continuous measurement using control charts. The procedures include blind samples to ensure proper background and the insertion of standards during analysis. Chemistry results are well documented and communicated by the MERLIN system.

#### 8.4. CHEMISTRY OPERATIONAL HISTORY

Plant has clearly established responsibilities for reporting and assessment. Technicians of laboratories are in charge of data recording in written as well as computerized form. Management of chemistry department is responsible for validation and reporting of results.

All analysis results performed by laboratories and on-line monitoring system are very well recorded in written as well as computerized form by SW system MERLIN. There are also threshold alarms of different colours that launch prompt correction actions in case of abnormal evolution of chemical parameters. Performing of corrective action is documented by system CAOLIN and also in written form.

Chemistry department creates monthly report with the trends of all-important parameters for primary, secondary and environmental chemistry, as well as a description of the state of all three barriers. Main events occurred in the plant are issued in yearly report.

Effective experience feedback has been established within the plant. The plant chemists regularly participate in meetings organized by CEIDRE for sharing of information with corporate level chemists.

#### 8.5. LABORATORIES, EQUIPMENT AND INSTRUMENTS

Laboratories are of appropriate space and very well maintained. All laboratories are equipped with modern instrumentation with sufficient redundancy and their cleanliness reaches the highest level.

Standard solutions and reagents are prepared and kept properly with a validity period defined.

Although the laboratories do not apply calibration labels directly on equipments, they have very good system for tracking of calibration, which is user friendly supported by SW MERLIN.

The plant has established a system for laboratory receipt, labeling, storage, conservation, usage, elimination for laboratory chemicals, which is very well maintained and supported by SW database. Laboratories keep a list of various chemicals in their possession. These substances are stored in specific cabinets. When a substance reaches expiry date, the chemistry sections withdraw usable stock and send it to logistics department's waste section to dispose it.

Staff thoroughly keeps protection against hazardous chemicals and solvents.

The plant has appropriate post accidental sampling system with facilities for safely obtaining, transporting, preparing and analyzing liquid and gas samples in accident conditions. There are installed fixed facilities for continuous boric acid measurement and plant radiation monitoring system (KRT) and fitted-out vehicles that are used to monitor radioactivity in the air as well as ambient gamma radiation. On national level (corporate laboratories CEIDRE) there are special mobile measuring devices.

The procedures for post accident sampling system are drawn up by corporate laboratories (CEIDRE). There are comprehensive procedures for the chemical and radiochemical analysis and sampling in the gas release phase of the reactor building and procedure for chemical and radiochemical sampling and analysis in the liquid phase of the reactor building.

The system is regularly tested and personnel is periodically retrained on the procedure of handling radioactive samples.

#### 8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

The plant has implemented a comprehensive quality control system elaborated by Nuclear Operation Division (DPN) and documented in “Reference Folder for Certification and Follow-up of Conditioning Chemical Product of Systems of NPPs”. Products and Materials for Use in Power Plants (PMUC) are sorted to 24 groups and for each group chemistry parameters with adequate purity are established. All chemicals and other substances under responsibilities of PMUC system are allowed to be used also in controlled area.

The criteria of purity and limit values of impurities for all operating chemicals are defined by CEIDRE. Every producer, product and packaging is certified by UTO (operational technical unit) and this certification is regularly updated.

Although the plant has implemented such comprehensive system PMUC, the team observed that some chemicals and substances were not properly designated to prevent of any inappropriate use. Also the plant has no complete programme for management of unsealed containers of chemical. The team suggested improvement in this area.

#### **BLAYAIS NPP FOLLOW-UP SELF ASSESSMENT**

The period following the OSART mission was an additional stage for continuing to roll out improvements initiated in 2005. It is also set against a specific backdrop as we are in the process of restructuring our organisation, by setting up a single laboratory and bringing together all plant and environmental chemistry activities under one entity.

At the same time, we have started implementing a progress initiative with regard to our environmental monitoring activities, with the aim of achieving ISO 17 025 accreditation (becoming a member of the national environmental monitoring network).

Our main objective is to improve management methods on the basis of site priorities : operational safety, industrial safety and management presence in the field.

Organisational progress has been accomplished with the compilation of comprehensive work packages for lab activities including risk assessment, experience feedback and detection of low-level events. These should be finalised with the delivery of our single laboratory

scheduled for the first half of 2007 and the setting up of our definitive organisational structure.

In addition, we have continued to roll out our human resources skills project : drawing up of reference standards specific to chemists, gradual implementation of work authorisation process based on shadow training, skills assessment in the field.

These actions are instrumental in fostering the total commitment of chemistry staff, while also improving our performance and the quality of services we provide to the various site structures (power operations, outage, etc.).

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

During the follow-up visit one recommendation and one suggestion were judged to be fully resolved. The satisfactory progress on last one suggestion was observed.

In order to follow the CEIDRE specifications for the end of rinsing process in decontamination, the plant has revised procedures for it. CEIDRE recommended to analyze chemistry parameters such as pH and total conductivity. Their limit values have been set for sufficient controlling the end of rinsing process in decontamination.

The corporate chemistry specifications policy-maker has updated the current chemistry specifications for the primary circuit regarding corrosion products and organic compounds. The plant has routinely monitored what this is necessary for normal power operation, including radioactive corrosion products and indirect chemistry parameters related to organic compounds. In case of deviations when parameters such as activated corrosion products, Fe, pH, sulfates are trending towards an out-of-normal operational value, the NPP then asks CEIDRE's hot laboratory at Chinon for the detailed values of the corrosion products and organic compounds. This laboratory is equipped with modern portable instrumental techniques for measurement of total organic carbon and corrosion products.

The plant has also revised the whole process of procurement and quality control of chemicals and other substances, clearly defining the responsibilities and authority of different departments within this process. Through the OLIMP electronic system (Safety sheets), criteria for quality and safety as well as extent of declared parameters verification with regard to purpose of particular use was implemented ensuring that only chemicals meeting defined criteria are being procured. For new, unused chemicals and substances, approval of the national entity (UTO) , health safety at work department and risk prevention department as well as CEIDRE is necessary before starting the procurement process. The chemicals and other substances have been jointly designated by green labels with the purpose of their usage, their expiry date, number of their batch, date of their opening etc.

## DETAILED CHEMISTRY FINDINGS

### 8.2. CHEMISTRY CONTROL IN PLANT SYSTEM

**8.2(1) Issue:** Although the plant has established and implemented the chemistry programme with the specifications of corporate entity (CEIDRE), it is not complete enough to ensure proper quality water chemistry and total organic compound:

- CEIDRE has established some criteria on the national level, but the plant does not use these criteria (except visual control) to assess the ending of the rinsing process in the decontamination to ensure removal of remains of corrosion products and decontamination solutions.
- Organic compounds are not analyzed during normal operation. In case of intrusion of resins into primary circuit, analysis of sulphates is considered for revealing this pollution. Intrusions of oils and lubricants are not considered.
- The plant does not provide analysis of Fe during start-up and also during normal operation. Gamma spectrometry analysis of isotopes of corrosion products only is insufficient for tracking the transport of the corrosion products in primary circuit and deposit formation.

Without additional analysis programme including establishment of chemistry specifications for primary circuit water and rinsing process in the decontamination, the risk of corrosion and uncontrolled formation of deposits in plant technology could increase.

**Recommendation:** The plant should follow the CEIDRE guidelines for the rinsing process in the decontamination to prevent corrosion and uncontrolled formation of deposits.

**Suggestion:** The plant should consider extending the current chemistry specifications for the primary circuit regarding organic compounds and corrosion products to prevent corrosion and uncontrolled formation of deposits.

**Basis:** IAEA TECDOC 489 para1.4 and best international practice.

#### **Plant response/action for the recommendation:**

In order to obtain meet radiological cleanliness criteria in the reactor pools during outage, chemical decontamination is performed after the end of fuel handling operations. Depending on contamination levels, alkaline and/or acid foams are pulverised. Rinsing is then done with demineralised water. Rinse termination criteria are based on the visual absence of decontaminant residue.

For the purpose of these operations, the plant uses procedure C306 based on PWR decontamination guidelines (2002 edition).

This procedure stipulates that:

- rinsing must be carried out with extreme care,

- the end of the process is determined by rinsing water conductivity (no value is specified in the document).

In order to clarify applicable chemistry criteria, we contacted the CEIDRE (DPN chemistry/environmental engineering entity) in order to determine which criteria should be measured and associated limits.

In April 2006, the CEIDRE responded with the following information :

“With regard to rinsing water, it would be more realistic to set oneself the following limit values :

- Total conductivity < 0.5  $\mu\text{S}/\text{cm}$
- $6 < \text{pH} < 8$

We will adjust these limit values if necessary, depending on experience feedback”.

In order to build up a store of experience feedback, reactor cavity rinsing operations were carried out as follows during the outage in 02/2006 :

- conventional rinse, followed by initial sampling of rinsing water,
- additional rinse, again followed by sampling of rinsing water.

The following results were obtained :

After unloading :

- First sample after 1 hour of rinsing :

Total conductivity = 14  $\mu\text{s}/\text{cm}$  and  $\text{pH} = 7.75$ .

- Second sample after additional rinse :

Total conductivity = 2  $\mu\text{s}/\text{cm}$  and  $\text{pH} = 6.8$ .

After refuelling :

- First sample around reactor vessel on 03/07/06 after 1st rinse

Total conductivity = 29.8  $\mu\text{s}/\text{cm}$  and  $\text{pH} = 7.7$ .

- Second sample around reactor vessel on 03/07/06 after 2nd rinse

Total conductivity = 16.0  $\mu\text{s}/\text{cm}$  and  $\text{pH} = 7.55$ .

These results were discussed with the CEIDRE in order to confirm applicable criteria for total conductivity and definitively adopt the process.

The effect of lengthening rinsing time in terms of effluent and additional worker radiation exposure has also been taken into consideration.

At the time, limited value of conductivity is 0.5  $\mu\text{s}/\text{cm}$ .

Final conclusions are expected by the end of 2006.

### **IAEA Comments:**

In order to follow the CEIDRE specifications for the end of rinsing process in decontamination, the plant has revised procedures for it. CEIDRE recommended to analyze chemistry parameters such as pH and total conductivity. Their limit values have been set.

Range of pH is set between 6 and 8. Total conductivity value is less than 0.5  $\mu\text{S}/\text{cm}$  and represents the rest of remains of inorganic and organic compounds. These parameters are established sufficiently for controlling the end of rinsing process in decontamination.

Moreover, CEIDRE has undertaken to distribute this process to other plants of EDF. A lot of tests are going to be carried out for setting new values at the end of the rinsing process in decontamination. This will also apply to all NPPs in France.

**Conclusion:** Issue resolved.

**Plant response/action for the suggestion:**

In response to this suggestion, we have contacted the CEIDRE, our corporate chemistry specifications policy maker, in order to find out what their position was.

The CEIDRE considered the current chemistry specifications for the primary circuit regarding the analysis of organic compounds and corrosion products to modify.

The reasoning behind this conclusion is the following :

Corrosion products, in particular iron and nickel, are produced by the widespread corrosion of primary circuit materials. These corrosion products are not at all harmful in terms of corrosion as they are natural components which are always found in water coming into contact with stainless steel.

The only potential adverse effect of metal oxides in the primary circuit might arise if these oxides are deposited on the core, with the formation of radioactive activation products that could adversely affect radiation exposure or cause nuclear flux deviations. Activation products in the primary circuit are monitored on a regular basis, thereby enabling us to indirectly monitor corrosion products. Atypical behaviour of corrosion products would be reflected in the atypical behaviour of activation products. In addition, monthly flux maps enable us to rapidly detect nuclear flux deviations due to abnormal deposits on fuel.

There are no plans to carry out any additional monitoring of corrosion products on a regular basis. This type of monitoring is only performed for research purposes and during cycles of limited length, in order to better understand the origin and transfer of corrosion products depending on certain operating parameters. This applies, for instance, to iron and nickel monitoring activities carried out in 2005 at Paluel 2 (cycle 15), Cattenom 3 (cycle 11) and Bugey 2 (cycle 23).

But in case some deviations CEIDRE laboratory are prepared to provide additional measurements by means of portable equipments

With regard to total organic carbon monitoring in the primary circuit, the CEIDRE policy is the same such as corrosion products policy.

**IAEA Comments:**

The corporate chemistry specifications policy-maker has updated the current chemistry specifications for the primary circuit regarding corrosion products and organic compounds. The plant has routinely monitored what is necessary for normal power operation, including radioactive corrosion products and indirect chemistry parameters related to organic compounds. In case of deviations when parameters such as activated corrosion products, Fe, pH, sulfates are trending towards an out-of-normal operational value, the NPP then asks CEIDRE's hot laboratory at Chinon for the detailed values of the corrosion products and

organic compounds. This laboratory is equipped with modern portable instrumental techniques for measurement of total organic carbon and corrosion products.

Moreover, CEIDRE is going to increase high temperature pH of primary circuit in the beginning of the campaign to avoid the speedy deposits formation of fuel assemblies in the event of a higher concentration of corrosion products and organic compounds. In this way the plant could prolong time for taking additional detailed measurements by the CEIDRE laboratory.

**Conclusion:** Satisfactory progress to date.

### 8.3. CHEMICAL SURVEILLANCE PROGRAMME

**8.3(a) Good practice:** The quality assurance system for the laboratories and continuous measurements is set to plan, perform, track and evaluate the results for both the laboratories and the on-line instruments. The quality assurance system also ensures a proper control for the chemical parameters during operations.

This quality assurance system is supported by software:

- MERLIN to guarantee that the specifications are respected, to programme the analyses, to key in, control and archive the results, to follow the evolution of measurements.
- CAOLIN to control and correlate several chemical parameters for cross checking (e.g. correlation between continuous cationic conductivity measurement and laboratory measurement of anions).

Analytical procedures for instruments are excellently prepared. Extensive tests are performed to quantify and demonstrate errors, sensitivity, reliability and stability of methods used.

Control instruments charts are designed to follow their metrological state. The validation process of measurements (including trend analysis) allows to evaluate the measurement method of chemical parameters in real time.

For setting traceability of measurements according to national reference standards, all the laboratories of the chemistry department are involved at the national level in intercomparison tests with CEIDRE and LNHB. Moreover, the environment laboratory is involved at the national level in intercomparison tests with the IRSN (Institute of Radioprotection and of Nuclear Safety).

Independent standards are used for laboratory and continuous measurement to avoid systematically mistakes. There is one standard for calibration, another for working standard during measurement and a third one for independent control.



## 8.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES.

**8.6(1) Issue:** Although the plant has a comprehensive system for Products and Materials for Use in Power Plants (PMUC), the principles for control of chemicals and other substances are not comprehensively complied with.

The team observed the following facts:

- There is no complete programme for management of unsealed container of chemicals.
- In the warehouse, some chemicals were not properly labeled with expiry data: Coolelf Supra GF NP for conditioning of diesel generator cooling water.
- Improper labeling of drum (label was stuck on the wall instead of the drum) with resin in continuous measurement room on secondary circuit unit 1, 2.
- In fuel building, emptied boric acid drums were used as drums for storage of protective shoe covers without change of designation.
- In fuel building, drums with decontamination solutions were observed without proper labeling. One was observed with illegible labeling and second one was labeled without expiry data and hazardous sign.
- A tank, which according to the person providing escort contains  $\text{Na}_2\text{CO}_3$ , was without labeling regarding the kind of chemical it contains. There was safety sheet with only with hazardous sign on the wall. Behind the tank, there was a drum with unknown substance.

Without a comprehensive programme for proper labeling and handling of chemicals in particular after the container's opening, there may be a higher risk for the corrosion status of equipment and a higher risk for health due to potential inappropriate use of chemicals.

**Suggestion:** Consideration should be given to comply more comprehensively with the principles for control of chemicals and other substances in order to provide to the users all necessary data to prevent a negative impact on technology and health.

**Basis:** IAEA TECDOC 489 para 1.4 and best international practice.

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

With regard to nuclear safety, the risk of using inappropriate substances on safety-related parts of the plant has been addressed by the use of substances bearing PMUC labels (substances or materials approved for use on nuclear power plants).

Since August 2006, a procedure drawn up by the warehouse has been applied by the plant, clarifying the rules governing the use of PMUC substances on site. It supplements existing procedures (industrial safety procedures “use and handling of chemicals”, “temporary and permanent storage of chemicals”). This is supplemented by a system of adhesive labels which

have now become mandatory for any temporary storage, handling and use of substances in special packaging.

All staff whose work involves handling activities have been instructed to refuse to move any container of which the content is not clearly identified.

Relevant staff will be briefed on the updating of these reference standards during the 4th quarter of 2006. Ways are now being examined in which to incorporate the initiative into plant-specific refresher training on nuclear safety, quality, industrial safety and the environment.

**IAEA Comments:**

The plant has revised the whole process of procurement and quality control of chemicals and other substances, clearly defining the responsibilities and authority of different departments within this process. Through the OLIMP electronic system (Safety sheets), criteria for quality and safety as well as extent of declared parameters verification with regard to purpose of particular use was implemented ensuring that only chemicals meeting defined criteria are being procured. For new, unused chemicals and substances, approval of the national entity (UTO) , health safety at work department and risk prevention department as well as CEIDRE is necessary before starting the procurement process. The chemicals and other substances have been jointly designated by green labels with the purpose of their usage, their expiry date, number of their batch, date of their opening etc.

Special attention is given by the plant to avoid harmful effects on health. The plant organised every two months safety morning that focuses on education training of plant staff and contractors. All staff whose work involves handling activities have been instructed to refuse to move any container of which the content is not clearly identified. The plant is going to provide preparatory meetings 6 months before the planned outage and every 3 years extensive professional retraining focused on handling with chemicals and other substances.

**Conclusion:** Issue resolved.

## 9. EMERGENCY PLANNING AND PREPAREDNESS

### 9.1. EMERGENCY ORGANIZATION AND FUNCTIONS

Blayais Nuclear Power Plant is located on the right bank of the Gironde Estuary in the Braud et Saint Louis district. The plant occupies a surface area of 230 hectares – known as the monitoring area. For off-site emergency planning purposes three emergency planning zones (EPZ) within the distance 2 km, 5 km and 10 km from the plant are established.

The responsibilities for emergency planning and preparedness are delineated and assigned among all bodies involved. The plant is responsible for reactor safety as well as for on-site emergency planning including emergency notifications of the local prefecture, national authorities and corporate EDF level. The local prefecture is responsible for protection of the public and off-site emergency response. The plant maintains the on-site emergency plan [in French: Le Plan d'Urgence Interne (PUI)], which replaces in case of emergency the normal, internal organization. The local prefecture maintains the off-site emergency plan [in French Le Plan Particulier d'Intervention (PPI)]. Emergency plans exist also at corporate EDF level, at nuclear safety authority level and at national level. The emergency plans at all levels are coordinated and consistent with each other.

The responsibility for drawing up and leading on-site emergency planning is delegated to the safety and quality manager. The operational coordinator of the task is the emergency planning and preparedness coordinator. It seems that this position has enough power, independency and disposable funds to manage the emergency planning activities. The EPP engineer is supported by a project type organizational body (emergency planning committee) composed of 18 members from the different plant departments.

The plant's emergency planning programme respects and follows the EDF's emergency planning requirements, which comprise 213 requirements. The set was updated in 2003. Coordination between plant and local emergency planning bodies is based on good daily relationship. It seems to be effective and consistent, however to continue this effort regular cooperation is encouraged.

### 9.2. RESPONSE FUNCTIONS

As soon as an event occurs outside normal operation, the PUI requires the sequence of emergency response functions to be performed to establish emergency management and operations.

The operations team in main control room (MCR) applies operating accident procedures and is not occupied with the emergency plan response activities. The shift supervisor takes over the command, evaluates the significance of the event supported by the diagnostic procedure (DOS), coordinates the immediate protective and corrective response measures and establishment of the local command post (PCL) in area of affected MCR. The shift supervisor notifies on-duty plant manager (PCD-1) who is delegated to make the decision to trigger the PUI and to notify the EDF corporate level and the off-site authorities (the prefecture and the nuclear safety authority). The on-duty plant manager takes over overall command of the on-site emergency response and has to be on-site in at least one hour.

The plant respects national emergency classification methodology, which distinguishes between

- conventional accidents requiring the conventional on-site emergency plan (PUI conventional) activation;
- radiological safety- related accidents requiring on-site radiological emergency plan (PUI).

The extent of plan activation depends on the type of the event. Four categories of on-site emergency plan (PUI) are specified: HORS PUI with no risk related to nuclear safety; INFRA PUI with potential risk to nuclear safety; CONVENTIONAL PUI with no nuclear safety risks and SAFETY AND RADIOLOGICAL PUI with impact on nuclear safety.

The classification system is different from the general international practice of classification methodology.

The on-site emergency response organisation is activated by external pager calls and phone calls. Additional emergency workers could be mobilized for repairs or for long-term emergency response. Additional mobilization and long term-shift emergency response is not tested in exercises. The on-site emergency response organization has to be operational in one hour.

The PCD-1 has to send the official written initial message 30 minutes after PCD is created. It is sent by fax to the prefecture and to the national authorities. Following this messages have to be sent to the local authority every hour. Written messages request information about INES classification of the event. Classification of the events according to the INES classification criteria is normally done later, not in the initial phase of the event.

General international practice recommends that the initial notification message should be sent in less than 15 minutes to the notification point, which is available 24 hours per day.

The emergency plan considers arrangements for executing the emergency response and mitigating actions to prevent an escalation of the threat, to protect the staff and to return the plant to a safe condition. The experienced and trained operation staff in the MCR ensures immediate response. The plant has also procedures for managing severe accidents (GIAG), which are triggered when specific plant conditions are reached. The organized emergency response of the on-site first responders (fire-fighters, first aid responders and security guards) provides effective protection to plant personnel and property.

Off-site support is provided on an agreement basis. Agreements with the off-site support providers are updated and seem to be complete. The plant has agreements with Departmental fire and rescue services for fire fighting support and medical support, which could be provided from the different centres around the plant.

The plant has strong technical support from EDF corporate level, it also benefits from the inter site assistance protocol between South-West region NPPs. Local support organizations are well equipped and available for anticipated emergency conditions.

Radiological consequence predictions are calculated using EDF's generic GEEE code which considers the type of accident scenarios and weather stability conditions. The applied intervention levels comply with the IAEA guidelines. The urgent protective actions: sheltering, evacuation, breathing protection and stable iodine usage are considered in dose

prediction calculations. The procedures for both computerized and alternate manual method of dose calculation exist and are applied during the exercises.

Off-site protective action recommendations are given to the Prefect. He has the authority to decide whether they should be applied. Emergency planning zones of 2 km, 5 km and 10 km are defined around the plant. In case of early radioactive release the Prefect allows the plant to warn the people in the 2 km EPZ by triggering 2 sirens without his prior approval. This supports well early sheltering.

The plant has two mobile environmental radiological monitoring teams. One team monitors the on-site area and another off-site area near the plant. Additional support could be provided by Civaux, NPP and Golfech NPP.

KI tablets were distributed in 2002 to the local population in 10 km EPZ.

The radiological consequences prediction task belongs to the “Assessment emergency centre” (PCC) team, which is located inside the BDS. The objectives of the PCC are to estimate the radiological consequence off-site, to carry out the radioactivity measurements on-site and off-site, to collect and provide data to the PCD and to coordinate efforts with the corporate EDF ETC-N crisis centre. The PCC is well organized to effectively execute the tasks. It consists of the calculation group, radiological measurements group and support group.

The plant has a number of masks and breathing apparatus in different locations including the MCR. The team has made a suggestion related to the use of respiratory protection.

The plant has process, radiological and meteorological instrumentation for assessing the plant status and development of emergency situations. Instrumentation is regularly tested and calibrated. The team encourages the plant to install radiation instrumentation inside the main emergency centres.

The technical data system (KIT-KPS) is installed in the MCR, LTC and at EDF corporate level (ETC-N).

The plant has set up the mini weather forecast website issued by Meteo France. The team has recognized this as a good practice.

Professionalism and high endeavours exist to provide the public with timely and accurate information in a case of emergency. In the frame of the overall on-site emergency response organisation the emergency response team consists of five professionals and support persons to perform the task. The team operates in the plant manager room (PCD-0) and next to the PCD. This arrangement shows the high level of importance associated to the emergency response function. The room is well furnished and has communication means, TV set, status boards and documentation needed for effective operation. The PCD-1 is delegated to issue the initial public information message in at least one hour after the initiation of the team.

In 2002, the plant has prepared a brochure about the public protective measures in case of radiological emergency at the plant. The brochure was distributed together with the KI tablets to the population in zone of 10 km radius around the plant. The brochure is updated every three years. The team encourages the plant to include the emergency protective rules for farmers and for transit population.

The plant is encouraged to develop emergency termination criteria and recovery phase of the emergency.

### 9.3. EMERGENCY PLANS AND ORGANISATION

The plant has established emergency response organisation (ERO) in accordance with EDF corporate rules and national regulatory requirements. Extension of ERO activation depends on the category of the PUI activated. The on-site ERO is integrated with EDF corporate, local and national ERO and covers the following emergency response functions: managing and coordination, expertise support and evaluation, action and communication.

ERO is modularly structured and respects integrated communications with common terminology. Designated command posts, positions and facilities are well specified.

The existing on-site emergency response organization has been assigned enough staff to provide for continuing – 24 hour emergency operations. ERO could be expanded from 77 individuals to over 400 individuals.

### 9.4. EMERGENCY PROCEDURES

In accordance with the EDF generic rules the plant has developed a set of site specific procedures, grouped in chapters A and C. Some of the procedures on a list are still under development. The procedures outline the on-site emergency response measures, and coordination with the off-site emergency response organisations. The on-site emergency response plan has a project type approach. The PUI also considers severe accident procedures (GIAG). The organisational approach to manage the severe accident situations is compliant with the international practices.

The first procedure within the set is titled “Preparation a la gestion d’une situation de crise” (PUI, HORS PUI, INFRA PUI) – D.5150.N.SSQ.0003.00. This procedure outlines the general description of the on-site radiological emergency response and the relations to the off-site radiological emergency response plans. The PUI is a regularly updated document; revision 0 is effective until March 2007. PUI has been assessed in exercises in 2004. The exercise evaluation results will be included in the next revision of PUI.

### 9.5. EMERGENCY RESPONSE FACILITIES

Several on-site emergency centres are established to carry out the emergency response functions. Coordinating and managing the on-site emergency response and coordination with the local responders from the main control room area is designated as PCCL centres in the initial phase of emergency. After the main command centre (PCD) is established the emergency managing and coordinating is transferred to this centre. The technical evaluation and MCR support is performed from LTC, the on-site and off-site radiological assessments and measurements are provided by the assessment emergency centre (PCC), public information activities are performed by the communication unit and logistic support, protective and corrective actions are made by logistic emergency centre (PCM).

After the storm of 1999, the plant built a structurally reinforced building (BDS) with ergonomic designed rooms to host most emergency command centres (PCD) with communication unit, logistic emergency centre (PCM), assessment emergency centre (PCC)

and the main site security centre (PCP). The team recognized the ergonomic design as a good practice.

In addition to the BDS, the plant has also dedicated other locations for purpose of emergency response:

- Local command centre (PCL) is established in the area of MCR with the purpose of initial emergency response, collecting the information and coordination of the protective and mitigating measures.
- Local emergency centres (LTC) are established in the area below the MCR (one per pair of units). It provides technical assessment of the unit status. The team has made a suggestion in relation to the equipment and evacuation procedure of the LTC.
- Security emergency centre (PCP) operates at the primary access point (PAP) it has emergency response tasks according to the PUI and security plan.
- The plant has dedicated 12 emergency connection points for emergency communications connections and starting point of emergency response teams. These points have communications cabinets for connection to the wire communications. The wire communications (including the plant paging system) are the main field communication means during emergency response. The team has made a suggestion related to communication means.
- 20 musters points are established at the plant site for evacuation means. The team has recognized a good practice related to the organization of the muster points.

## 9.6. EMERGENCY EQUIPMENT AND RESOURCES

The plant has emergency equipment and resources in different locations. Equipment is in good condition and is regularly checked, tested or reviewed. The EP coordinator maintains a list of equipment for testing and checking. The plant has arrangements with off-site institutions and support from EDF corporate level if specific heavy equipment is necessary.

## 9.7. TRAINING, DRILLS AND EXERCISES

The plant has integrated training and drills programme where full-scope simulator and compact post-accident simulator (SIPACT) are used for the training and development of skills of the staff manning the emergency technical centres. The combination of full-scope simulator and SIPACT enables the emergency staff to witness a scenario that would resemble a real situation as closely as possible and to access the skills required to perform specific tasks assigned to particular emergency centre. The EP training programme consists of initial training, refreshing training, specific training and drills, command post centres drills and exercises.

Clear and consistent evaluation criteria lists are prepared in order to evaluate individual skills and overall emergency management. The findings of drills/exercises evaluation are subject to the validation and feedback integrated in the local training programme.

Training, drills and exercises are planned annually and have to be approved by plant management. Each member of emergency response organisation has to complete initial

training to become qualified for the mission in emergency response organisation. Records of attended training and exercises are maintained for each person.

## 9.8. QUALITY ASSURANCE

The plant has established the EP QA programme in accordance with the QA requirements, in order to maintain and improve the degree of availability and effectiveness of emergency planning and maintaining activities. The programme covers training, exercises and drills, maintenance of EP equipment, communications and facilities and EP performance indicators.

The plant has established 6 stages on the controlled “nomination list”. Each stage is precisely specified on the list and has to be checked by the responsible person when it is done. The nomination list considers training requirements, duty mission requirements, skill requirements and knowledge of the facilities. Finally the EP coordinator verifies the completeness of the nomination procedure and put the candidate on a duty list.

### **BLAYAIS NPP FOLLOW-UP SELF ASSESSMENT**

The OSART review of EPP benefited the site as it helped us to question certain practices which we had previously deemed to be in line with reference standards.

The results of the EPP review and in particular, the absence of any recommendations in this area, showed us that we were on the right track.

The 3 suggestions issued by the reviewers were incorporated into the EPP committee’s action plan. Where the fitting out of emergency logistics centres was concerned, the suggestion was dealt with locally. Where investigations into the use of respiratory masks in the control room or the installation of cordless phones were concerned, we were assisted by our corporate offices.

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

In the area of Emergency Planning and Preparedness two suggestions have been resolved and response to one suggestion has achieved satisfactory progress to date.

In response to the suggestion concerning the effectiveness of respiratory protection, the plant consulted the manufacturer of the respiratory masks as well as firemen. Staff wearing spectacles and having to use respiratory protection were provided special spectacles with design fit for use inside the masks. By this arrangement the issue is resolved; however, follow-up of actual usage of these special spectacles would be advisable.

The suggestion about improving communication during emergency mitigating action by wireless communication devices is being dealt within the framework of a corporate-led project. There will be about 260 phones distributed to operations, maintenance and security staff. About 15 phones will be reserved to support emergency management functions. 40 % of the local transmitter/receiver devices are already functional. Training in the use of these new phones will take place soon. The system will be fully operational at the site after the refueling outage of unit 1 in 2007, by which time protection against electromagnetic interference for I&C equipment will be installed. This is considered as satisfactory progress to date.



In response to the suggestion to improve protection of staff in the local technical emergency centers, additional measurement and protection equipment was installed in these centers and also in the main control rooms. The consideration by the plant, which concluded that a new procedure for evacuation of the LTC is not required was agreed to be reasonable. This way, this issue is resolved.

## DETAILED EMERGENCY PLANNING AND PREPAREDNESS FINDINGS

### 9.2. RESPONSE FUNCTIONS

**9.2(1) Issue:** Respiratory protection could be ineffective due to the difficulties in communications, problems with spectacles, fit to face configuration and overall personal fitness for use of the equipment.

The use of respiratory equipment is of the greatest significance for the protection of the emergency workers and effective emergency response in case of severe conditions. For this purpose the plant has a sufficient number of masks and self-contained breathing apparatus to be used in different locations, including for operators in MCR. The respiratory equipment is uniform and it is regularly tested. Additional quantity of the respiratory equipment could be provided by the off-site professional fire brigade. The emergency workers are trained and have skills on use of the respiratory equipment.

In spite of good general impression, the following concerns regarding the efficient use of respiratory equipment are evident:

- difficulties in communications,
- problems with spectacles,
- fit to face configuration,
- overall personal fitness for use of the equipment.

Without addressing these concerns the use of respiratory equipment could be in some cases inefficient. Consideration and resolving of such type of problems could not just improve the safety protection level of staff, but could also be an indication of good safety awareness.

**Suggestion:** The plant should consider improving the efficient use of respiratory protection equipment.

**Basis:** IAEA Safety Standard NS-R-2, para 8.2, 8.4, 8.5 and best international practice.

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

##### On communication difficulties :

The masks forming part of our respiratory equipment are fitted with a device which enables staff to communicate with each other.

If it is found to be defective during annual maintenance, this device - referred to by the manufacturer as a “speech diaphragm” - can be replaced as it features on the list of spare parts.

On problems potentially caused by wearing glasses :

It has been proven that the wearing of prescription glasses can interfere with seal integrity.

In order to deal with this potential malfunction, the medical centre refers staff members who wear glasses to an ophthalmology centre which produces special glasses for use with breathing masks. These glasses are specially fitted with a sufficiently flexible frame and flat arms, enabling them to be used with breathing masks. The provision of these glasses or their renewal in the event of changes in eyesight is reviewed on the occasion of routine medical examinations.

On correctly fitting equipment and general ability to use equipment :

During 2nd-line fire training sessions for maintenance staff, 3rd-level fire training sessions, or drills and practice sessions for operating staff :

- Practices concerning the use of this equipment are taught and put into practice:
- fitting of mask (positioning of tightening straps, fitting to the face),
- integrity test (mask fitted snugly, negative pressure check before hooking up to air supply system, cylinder).
- To date, none of the above-described measures or experience feedback from training close-out sessions have revealed any shortcomings on the part of staff having to use this equipment.

Additional analysis : In addition, 4 self-contained breathing devices have been installed at the entrance to each of these control rooms. Placed at the disposal of control-room operators, this additional equipment is intended to make them more autonomous in the performance of any operating activities.

**IAEA Comments:**

The plant consulted the manufacturer of the respiratory masks and firemen concerning the suggestion made by OSART. No communication difficulties have been observed during exercises, so experience shows that the “speech diaphragm” of the respiratory mask functions properly. Problems of fitting of masks to face also have not been experienced. Staff wearing spectacles and having to use respiratory protection were provided special spectacles with design fit for use inside the masks. Follow-up of actual usage of these special spectacles would be advisable. Overall fitness for use of a respirator mask is evaluated during medical examination.

**Conclusion:** Issue resolved.

**9.2(a) Good practice** Weather forecast website applied proactively to support emergency response initiation.

Bearing in mind the significance of risk of severe weather events, the plant has set up the mini “weather forecast website” issued by Meteo France. This is an exclusive application for the plant and aims to monitor local weather conditions and make predictions regarding the preparedness measures to the anticipated weather conditions. The web site comprises a seven day forecast for the Gironde region, a set of forecast, report every three hours period, and infrared satellite images every six hours.

According to this local weather forecast and anticipated weather conditions the preventive measures could be initiated in the plant. In case of anticipating severe weather the plant prepares the units and the emergency plan (PUI) can be triggered. So emergency staff can arrive on-site before severe weather conditions reach the site.

The application could be an example for other plant with severe weather operating experiences.

## 9.5. EMERGENCY RESPONSE FACILITIES

**9.5(1) Issue:** Emergency mitigating actions in the field may not be effective enough because the communication means between the emergency response teams and the command centers are only wire communications.

The plant has twelve emergency connection points with communications cabinets for connecting the wire communications. The wire communication system (including the plant page system) is the main on-site means for communication during the emergency mitigation in the field outside or inside the technological buildings. The emergency mitigating actions in the field (for example radiological measurements, corrective actions, fire fighting, first aid etc.) have to be effective and with a minimum additional risk to the emergency responders.

Without wireless communication means the effectiveness of the on-site field emergency mitigating actions could be decreased.

**Suggestion:** Consideration should be given to establishing a wireless on-site field communication system to the existing wired communication system.

Most other nuclear plants (France excluded) use the on-site field radio communication system for this purpose.

**Basis:** IAEA Safety Standard NS-R-2, para 2.38 and best international practice.

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

Long before we hosted our OSART mission, the French nuclear plants were already aware of the need to equip its sites with cordless telephones. Cordless telephone equipment formed part of a huge corporate-led project to renew telecommunications equipment. This 8 million-Euro project is now being rolled out across the sites.

The DECT mobile phone system is aimed at :

- Improving operational communication within the power operations and outage structures,
- Protecting staff members working alone

An exploratory interview was conducted among all plant teams (all crafts and staff levels) in order to record all requests of future users. A risk assessment document focusing on human factors was drawn up. The plant has produced a users charter as well as a reminder of industrial safety, nuclear safety and communication rules.

The project was submitted to the extended senior management committee in November 2005 and to the Safety Operations Committee on 22 February 2006, and is scheduled to be rolled out in 2006/2007. In view of safety issues (avoiding reactor scrams), the installation of these cordless phones requires the reinforcement of control and protection cabinets, which can only be done during refuelling outages. As a result, implementation will only be finalised at the beginning of May 2007, after work has been completed during the unit-1 outage 1 in 2007 (work done in 2006 on units 2, 3 and 4).

**IAEA Comments:**

There will be about 240 local transmitter / receiver devices to maintain contact with the portable phones; about 40% of them are working. 260 phones will be distributed to operations, maintenance and security staff. About 15 phones will be reserved to support emergency management functions. Training to use the new phones will take place soon. The system will be fully operational at the site after the refueling outage of unit 1 in 2007, by which time protection of I&C equipment against electromagnetic interference will be installed.

**Conclusion:** Satisfactory progress to date.

**9.5(2) Issue:** Additional means of protecting the staff in the local technical emergency centre (LTC) could be improved.

In case of activation of the on-site radiological emergency response plan (PUI) level 4 the LTC is established. The main missions of the LTC are evaluation of the technical status of the affected unit, consultation with the EDF corporate expertise level, decision-making support to the PCD and conveying diagnosis/prognosis status to PCC. LTC functions could be comparable to the TSC (technical support centre) determined by international practices and standards. LTC is located in the place under the Main control rooms of 1/2 and 3/4 units.

Although the LTC is supplied with controlled ventilation and radiation shielded area, the staff in LTC does not have the ability to control the radioactivity level in the rooms of the LTC and to have protection. In accordance with the international recommendations appropriate measures should be taken to protect the occupants in LTC for a protracted time against hazards resulting from severe accidents. Procedure of evacuation of LTC is not established.

Without adequate arrangements the function of the LTC and protection of the staff inside the LTC could be less effective in case of severe accident.

**Suggestion:** Consideration should be given to providing additional means for protecting the staff in the LTC in case of severe accident and to including the procedure in the PUI for evacuation of the LTC to an alternate location.

Good international practice provides means to protect the staff of the technical support center include instruments to permanently measure dose rates and the level of air radioactivity inside the center, dosimeters, protective clothes, respiratory protection, battery lamps, KI tablets, first aid kit, etc.

**Basis:** IAEA Safety Standard No.GS-R-2.

**Plant response/action:**

By design, local emergency centres are protected by a ventilation system fitted with iodine filters (like control rooms). In addition, we worked on the premise that the RP store located at 0m in the same building, at the entrance to the RCA (nuclear auxiliary building) could be easily accessed by ELC or PCL teams, and did not require the installation of additional equipment in these areas. In late 2005 however, working on the hypothesis of a failure in the ventilation system or abnormal atmospheric conditions between these rooms and the nuclear auxiliary store, the group looked into additional equipment that could be installed in ELCs to protect staff working inside them or having to go to the 0-metre level. As a result of this investigation, an additional cabinet was installed in each ELC, containing a radiation meter, gloves, a film badge, a torch, over-boots, Tyvek coveralls, a sealed box of iodine tablets etc.

With regard to respiratory protection, 2 self-contained breathing devices are available at the entrance to the room, as well as at each level of the staircase leading to the ELC.

In the event of having to provide staff with additional protective equipment, we have a reserve supply in the RP store located on the 0-m level of the same building, and we are logistically able to transport IRP-type cartridge respirators stored in the emergency building and designed for this purpose.

First-aid kits have not been added as they are available in the control rooms and on the 0-m level at the entrance to the nuclear auxiliary building.

With regard to the writing of an ELC evacuation procedure, a distinctive feature of the plant is that it has an ELC for each twin-unit group. These ELCs and their telephone numbers are identical. (The switchboard is operated by site security staff in the BDS building). It is left to the discretion of PCD1 to activate either of the ELCs. If a transfer were necessary, it would meet the same rules as the transfer or evacuation from a muster point towards another muster point or the outside. Coordinated by PCM1 and supervised by the PCM rescue branch, it would not pose any specific problems, as these transfers are simulated and tested during annual drills.

It should be noted that investigations into the installation of additional equipment in the ELCs led the group to conduct the same investigation for all emergency centres.

At the same time, we decided to equip control rooms (PCL) with similar equipment, in addition to that already available.

**IAEA Comments:**

Additional cabinets containing measurement and protection equipment to be used in emergency situations were installed in the local technical emergency centers (LTC) and in the corridors adjacent to the main control rooms. The actual content of these cabinets was checked and found to be in line with the specifications. The consideration by the plant concluding that a new procedure for evacuation of the LTC is not required was agreed to be reasonable.

**Conclusion:** Issue resolved.

**9.5(a) Good practice:** Ergonomic design of the building hosting emergency response facilities.

After the storm of 1999, the plant has built the structurally reinforced building (BDS) with ergonomically designed rooms to host the emergency command center (PCD) with communication unit, logistic emergency center (PCM), assessment emergency center (PCC) and the main site security center (PCP). The BDS is constructed to protect personnel against outside aggressions and can operate autonomously. Ventilation, shielding, air conditioning, independent power supply, food and water reserves, rest and clean area telecommunications and data systems assure long term habitability and working conditions in case of emergency.

The building has a decontamination room to deal with cases of contamination on the site and telecommunication room for sending and receiving messages. The centers in BDS are equipped with commercial and dedicated communication systems for off-site and on-site communications, data systems, video terminals and different status boards. Procedures, actions list, manuals and other documentation are updated and very well maintained. The computerized log linked up to the entire network provides an effective means of keeping record of the emergency mitigating measures sequences. The emergency staffs in BDS wear tabards in accordance with the particular centres to identify their function. Room colors are identical to tabards colours and to the colours of computerised log blocks.

**9.5(b) Good practice:** Good organization of muster points.

On a typical working day more than 1000 workers could be present on-site. In case of an emergency situation the evacuation of such a number of staff has to be carried out in an organized and effective manner. At the same time the emergency response staff has to assembled and be coordinated for emergency response.

Before 1999 the plant had used only seven muster points for this purpose. Based on operating experiences from the year 1999 the concept of muster points is changed and 20 muster points were established over the plant site. The distribution of the muster point locations over the plant site has been selected to take into account gathering of the staff fast, sheltering and accommodation possibilities.

Muster points are well designated and have cabinets with the first aid kit, KI tablets, radiological survey meters, protective clothes, loudspeakers, lamps and other equipment to manage the assembled group of staff. A computerized counting system is installed at each cabinet to account for and to record staff based on readers of badges the staffs presents at the muster point. For effective response and communications with the Logistic emergency centre (PCM) the push button alerting system is installed enabling muster point officers to report in or ask for assistance. This arrangement allows organized communication and faster coordination between each muster point and PCM. Each muster point has two phone line connections with the PCM and announcement system (page system). The announcement system could be reached locally or from the PCM's command panel. A local or overall announcement from PCM's command post is possible. This arrangement allows the coordination and instruction of the particular muster points in case the emergency being limited to part of the on-site area. A monthly surveillance test is conducted by muster point officers to check the operability of the muster points.



General arrangements and organisation of muster points, the installation of a push button system to facilitate communications between muster point and PCM could be examples for other plants looking for improvements to their muster points arrangements.

**SUMMARY OF STATUS OF RECOMMENDATIONS AND SUGGESTIONS  
OF THE OSART FOLLOW-UP MISSION TO BLAYAIS NPP  
November 2006**

	ISSUES PROPOSED	RESOLVED	SATISFACTORY PROGRESS	IN- SUFFICIENT PROGRESS	WITHDRAWN
MOA	R – 2 S – 2		2 2		
TQ	S – 3	2	1		
OPS	R – 4	1	3		
MA	R – 1 S – 1	1	1		
TS	R – 1 S – 3	1 2	1		
OE	R – 1 S – 1		1 1		
RP	R – 1	1			
CH	R – 1 S – 2	1 1	1		
EPP	S – 3	2	1		
<b>TOTAL R</b> (%)	R – 11 100%	R – 5 45%	R – 6 55%	-	-
<b>TOTAL S</b> (%)	S – 15 100%	S – 7 47%	S – 8 53%	-	-
<b>TOTAL</b> (%)	26 100%	12 46%	14 54%	-	-

## DEFINITIONS

### DEFINITIONS – OSART MISSION

#### **Recommendation**

A recommendation is advice on what improvements in operational safety should be made in that activity or programme that has been evaluated. It is based on IAEA Safety Standards or proven, good international practices and addresses the root causes rather than the symptoms of the identified concern. It very often illustrates a proven method of striving for excellence, which reaches beyond minimum requirements. Recommendations are specific, realistic and designed to result in tangible improvements. Absence of recommendations can be interpreted as performance corresponding with proven international practices.

#### **Suggestion**

A suggestion is either an additional proposal in conjunction with a recommendation or may stand on its own following a discussion of the pertinent background. It may indirectly contribute to improvements in operational safety but is primarily intended to make a good performance more effective, to indicate useful expansions to existing programmes and to point out possible superior alternatives to ongoing work. In general, it is designed to stimulate the plant management and supporting staff to continue to consider ways and means for enhancing performance.

*Note: If an item is not well based enough to meet the criteria of a ‘suggestion’, but the expert or the team feels that mentioning it is still desirable, the given topic may be described in the text of the report using the phrase ‘encouragement’ (e.g. the team encouraged the plant to...).*

#### **Good practice**

A good practice is an outstanding and proven performance, programme, activity or equipment in use that contributes directly or indirectly to operational safety and sustained good performance. A good practice is markedly superior to that observed elsewhere, not just the fulfillment of current requirements or expectations. It should be superior enough and have broad application to be brought to the attention of other nuclear power plants and be worthy of their consideration in the general drive for excellence. A good practice has the following characteristics:

- Novel;
- Has a proven benefit;
- Replicable (it can be used at other plants);
- Does not contradict an issue.

The attributes of a given ‘good practice’ (e.g. whether it is well implemented, or cost effective, or creative, or it has good results) should be explicitly stated in the description of the ‘good practice’.

*Note: An item may not meet all the criteria of a ‘good practice’, but still be worthy to take note of. In this case it may be referred as a ‘good performance’, and may be documented in the text of the report. A good performance is a superior objective that has been achieved or a good technique or programme that contributes directly or indirectly to operational safety and sustained good performance, that works well at the plant. However, it might not be necessary to recommend its adoption by other nuclear power plants, because of financial considerations, differences in design or other reasons.*

## DEFINITIONS – FOLLOW-UP VISIT

### **Issue resolved – Recommendation**

All necessary actions have been taken to deal with the root causes of the issue rather than to just eliminate the examples identified by the team. Management review has been carried out to ensure that actions taken have eliminated the issue. Actions have also been taken to check that it does not recur. Alternatively, the issue is no longer valid due to, for example, changes in the plant organization.

### **Satisfactory progress to date – Recommendation**

Actions have been taken, including root cause determination, which lead to a high level of confidence that the issue will be resolved in a reasonable time frame. These actions might include budget commitments, staffing, document preparation, increased or modified training, equipment purchase etc. This category implies that the recommendation could not reasonably have been resolved prior to the follow up visit, either due to its complexity or the need for long term actions to resolve it. This category also includes recommendations which have been resolved using temporary or informal methods, or when their resolution has only recently taken place and its effectiveness has not been fully assessed.

### **Insufficient progress to date – Recommendation**

Actions taken or planned do not lead to the conclusion that the issue will be resolved in a reasonable time frame. This category includes recommendations on which no action has been taken, unless this recommendation has been withdrawn.

### **Withdrawn – Recommendation**

The recommendation is not appropriate due, for example, to poor or incorrect definition of the original finding or its having minimal impact on safety.

### **Issue resolved – Suggestion**

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been fully implemented or the plant has rejected the suggestion for reasons acceptable to the follow-up team.

### **Satisfactory progress to date – Suggestion**

Consideration of the suggestion has been sufficiently thorough. Action plans for improvement have been developed but not yet fully implemented.

### **Insufficient progress to date – Suggestion**

Consideration of the suggestion has not been sufficiently thorough. Additional consideration of the suggestion or the strengthening of improvement plans is necessary, as described in the IAEA comment.

### **Withdrawn – Suggestion**

The suggestion is not appropriate due, for example, to poor or incorrect definition of the original suggestion or its having minimal impact on safety.

## LIST OF IAEA REFERENCES (BASIS)

### *Safety Standards*

- Safety Series No.110**; The Safety of Nuclear Installations (Safety Fundamentals)
- Safety Series No.115**; International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources
- Safety Series No.120**; Radiation Protection and the Safety of Radiation Sources: (Safety Fundamentals)
- NS-R-1**; Safety of Nuclear Power Plants: Design Requirements
- NS-R-2**; Safety of Nuclear Power Plants: Operation (Safety Requirements)
- NS-G-1.1**; Software for Computer Based Systems Important to Safety in Nuclear Power Plants (Safety Guide)
- NS-G-2.1**; Fire Safety in the Operation of Nuclear Power Plants (Safety Guide)
- NS-G-2.2**; Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants (Safety Guide)
- NS-G-2.3**; Modifications to Nuclear Power Plants (Safety Guide)
- NS-G-2.4**; The Operating Organization for Nuclear Power Plants (Safety Guide)
- NS-G-2.5**; Core Management and Fuel Handling for Nuclear Power Plants (Safety Guide)
- NS-G-2.6**; Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants (Safety Guide)
- NS-G-2.7**; Radiation Protection and Radioactive Waste Management in the Operation of Nuclear Power Plants (Safety Guide)
- NS-G-2.8**; Recruitment, Qualification and Training of Personnel for Nuclear Power Plants (Safety Guide)
- NS-G-2.9**; Commissioning for Nuclear Power Plants (Safety Guide)
- NS-G-2-10**; Periodic Safety Review of Nuclear Power Plants (Safety Guide)
- 50-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 to the Blayais 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 Blayais 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.

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### EXPERTS:

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Review area: Operations 1

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Review area: Emergency planning and preparedness

**LANGE, David**

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Team Leader

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Review area: Operations 2

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Review area: Technical support

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Deputy Team Leader

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Team leader

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### **PETRECKI, Igor**

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IAEA

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Review areas: Technical Support, Operating Experience