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INTERNATIONAL ATOMIC ENERGY AGENCY

REPORT OF THE

OSART

(OPERATIONAL SAFETY REVIEW TEAM)

MISSION

TO THE

BUGEY

NUCLEAR POWER PLANT

FRANCE

8 TO 25 MARCH 1999

AND

FOLLOW-UP VISIT

5 TO 9 JUNE 2000

DIVISION OF NUCLEAR INSTALLATION SAFETY

OPERATIONAL SAFETY REVIEW MISSION
IAEA-NSNI/OSART/00/104F

PREAMBLE

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

This report also includes the results of the IAEA's OSART follow-up visit which took place 15 months later. The purpose of the follow-up visit was to determine the status of all proposals for improvement, to comment on the appropriateness of the actions taken and to make judgements on the degree of progress achieved.

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

FOREWORD
by the

Director General

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

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

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

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

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

CONTENT

INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the invitation of the Government of France, an IAEA Operational Safety Review Team (OSART) of international experts visited the Bugey Nuclear Power Plant from 8 to 25 March 1999. The plant is located in the south-east of France, in the Rhône-Alpes region, of the department of Ain. The site comprises of four PWR type reactors of 900 Mwe each. Units 2 and 3 were first connected to the grid in 1978 and Units 4 and 5 in 1979.

The Bugey OSART mission was the 104th in the programme which began in 1982. The team was composed of experts from Belgium, Canada, Hungary, South Africa, the United Kingdom and the United States of America together with the IAEA staff members and observers from Lithuania, the People's Republic of China and Switzerland. The collective nuclear power experience of the team was in excess of 300 years.

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; Radiation Protection and Chemistry. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

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

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 the content of programmes. The conclusions of the OSART team were based on the plant's performance compared with good international practices.

At the request of the Government of the France, the IAEA carried out a follow-up to the Bugey OSART mission from 5-9 June 2000. The team comprised of four members, one from USA and three from the IAEA. Three of the four reviewers in the team had been members of the original OSART team. The purpose of the visit was to discuss the action taken in response to the findings of the OSART mission.

During the five days visit, team members met with senior managers of the Bugey Nuclear Power Plant and their staff to assess the effectiveness of their responses to recommendations and suggestions given in the official report of the Bugey OSART mission. The team provided comments on the responses, provided some additional suggestions for improving response actions and categorized the status of response actions. Definition of categories of response status and a summary of the results in a quantitative manner are provided at the end of this report.

MAIN CONCLUSIONS

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

– The OSART team was impressed with the openness and candor of all managers and staff. All demonstrated an eagerness to learn from what the team members had to say and expected the team to provide pertinent proposals for improvement.

– The station has excellent facilities in support of the staff, including the facilities to deal with emergencies and a training center that uses extensive mock ups and several types of mini-simulators to enhance knowledge.

– The desire and attitude for improvement was evident by the efforts to raise standards in many areas over the past year. This is a good indication of the future standards which can be attained by the plant.

A number of opportunities for improvements in operational safety were offered by the team. The most significant include the following:

– Management expectations for performance have not been clearly established or effectively communicated to plant staff at all levels.

– Improvements are needed in human performance as evidenced by poor worker practices in several areas including industrial safety, radiological protection, maintenance activities and daily operations.

– Significant weaknesses in the radiological protection programme exist due to a lack of station-wide management emphasis along with insufficiently effective oversight and controls.

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

FOLLOW-UP MAIN CONCLUSIONS

The follow-up team received excellent co-operation from the Bugey staff and was impressed by the progress that had been made, openness, frankness and desire to learn exhibited by all staff during the visit. The willingness of the plant management to consider new ideas and implement operational safety changes is a positive indicator of the potential of the plant to achieve continued future success. In all cases, agreement was reached with the Bugey management on the assessment of the actions implemented.

The plant has done a thorough analysis of the root causes to issues identified during the OSART mission resulting in 110 actions where the plant management established written expectations.

Above all, for the year of 2000, plant management has given the highest priority to Industrial Safety and Radiation Protection. The strategic plan has been revised to show this. Expectations have been communicated to the departments concerned and included in the management contracts of the department heads.

Several of these actions to improve the plant performance have shown positive results and a great majority of the issues were found to either be resolved or making satisfactory progress.

Plant management has demonstrated a significant commitment to the radiation protection programme and has taken actions to elevate its importance to the same level as nuclear safety. A work site training facility is under construction in unit 1, where initial and refresher training will be provided on how to enter the RCA, contamination control and how to set up a work site.

In the operation organization, exemplary team work was observed in their corrective action efforts related to OSART issues. Ownership has been taken for the correction of labeling, revising procedures and housekeeping improvements.

On the other hand, two issues have not reached the level of satisfactory progress. These are related to management expectations and material conditions. Several good initiatives have been taken but the results achieved show that the senior management and management supervisor staff must, on a day to day basis, continue to reinforce their expectations in areas such as industrial safety, material condition and where cultural changes are needed. Targets linked to a vision should be used to monitor progress . Greater senior management presence in the field communicating expectations is needed in order to make further progress in the areas mentioned above.

A statistical analysis of the status of the 29 recommendations and 6 suggestions identified in the OSART mission in March 1999 shows that 46% were resolved, 48% were making satisfactory progress and 6%(two issues) were making insufficient progress. Several of the resolved issues were category specific and limited in scope. The remaining issues are in many cases related to needed cultural changes and will need considerable more effort and attention to be resolved.

1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

1.1. CORPORATE ORGANIZATION AND MANAGEMENT

Bugey NPP is a four unit 3600 MWe plant operated by Electricité de France (EDF). The plant has been in operation since 1978. The Bugey site also contains a gas cooled reactor which has been shutdown since 1994 and is being converted to the Safe Store state. In addition, the site houses the inter-regional fresh fuel storage facility, a corporate heavy equipment storage facility, a reactor coolant pump repair shop for all EDF plants and a training facility. An adjacent greenhouse facility is heated by warm water from Units 4 and 5.

The Plant Director reports to an operations manager in the Corporate Nuclear Generating Division. This division is comprised of two Operations Managers (one for Group 1 units and one for Group 2 units), a Technical Manager, a Safety Team leader, financial management, communication and human resources. Corporate policies have been established which give clear statements to the Plant Director on his responsibilities for safety. These responsibilities are further reinforced in a formal management contract. This contract establishes specific objectives for safety as well as for production and cost.

There is a strong focus on nuclear safety at corporate, however, the policy on fitness for duty could be strengthened. In particular, the team recommended that an EDF and Bugey strategy should be developed to prohibit the consumption of alcohol on the site.

1.2. PLANT ORGANIZATION AND MANAGEMENT

Bugey has established a clear organizational structure. This structure is described in the plant Quality Manual. The Plant Director has overall responsibility for the site with specific responsibilities for the safety, quality, radiation protection, technical, financial and communications departments. The Deputy Plant Director has responsibilities for production, maintenance, administration, modifications and day to day plant operation.

The responsibilities for nuclear safety have been specifically delegated from the Plant Director to the head of the production for Units 2-5. This responsibility is further delegated to the shift managers.

A Safety Engineer is provided to ensure an independent review of safety critical activities.

A recent organizational change has been made to incorporate industrial safety and radiation protection into the safety and quality group. This is intended to provide a consistent focus in the field of industrial safety.

A Bugey strategic plan has been produced and covers the period from 1996 to 2000. The stated goal of the strategic plan is to: “Rejoin the top half of French nuclear power plants by the mid-life of our installations, thanks to the association of everyone and the improvement of our performance.”

Input to the strategic plan was obtained from plant staff, unions and local politicians. Eight large projects were initiated as a result of this plan. For example, improve the Quality Manual, initiate a self-assessment process and improve the outage organization.

An extensive project to improve and simplify the QA manual was undertaken. All policies were reviewed and ten strategic areas were identified. A significant effort was also made to communicate the strategic plan and the policies to all staff. Senior plant managers made the presentation in several four hour sessions over a three month period in 1998.

Plant management introduced several initiatives to improve safety culture. This included safety culture survey, a self-assessment process and the utilization of a human factors consultant.

A Safety Culture Survey tool was developed in 1996 and was used on a trial basis at three EDF plants in 1996/1997. This questionnaire is used to determine staff perceptions of safety. At Bugey, for example, the results indicated that improvements were needed in plant staff's knowledge of their role and in management communication. The results of the survey were communicated to plant staff. Bugey repeated the survey in late 1998 and the results showed improvements in the above two areas. The team supports continued use of this tool combined with management follow-up actions.

Plant management is also to be commended for initiating a self-assessment process in 1996. A self-assessment process is one of the fundamental building blocks of an excellent performing plant. The team has suggested some improvements to this process to improve the earlier detection of deteriorating safety trends and bringing about the needed improvements in those areas. The programme could also be enhanced by a routine consolidation of the results in each department with a review by the department management committee and the site management committee. The team believes other EDF plants could also benefit from this process.

A human factors consultant position was created and staffed to provide analysis of events from a human factors perspective and recommendations on how human behaviors can be improved. A network of human factors representatives is being added to several departments and a steering committee provides an overview of the results. The programme might be enhanced by visits to other international plants or workshops and improved training of human factors department representatives.

Management contracts have been established throughout the organization. A site management contract provides the overall objectives and is supported by key indicators. Division and department contracts are also established that support the achievement of the site contract objectives. Performance is monitored monthly and corrective actions initiated where required.

A system of performance indicators has been implemented that is comprehensive in most areas. However, it was noted that in some cases, comparisons were made with only EDF performance rather than the best that has been achieved worldwide. It was also noted that performance indicators were not established in some areas.

Plant management has not always established or communicated clear expectations in some areas. This sometimes results in EDF and contractor performance that does not meet current industry standards. The team recommended improvement in establishing expectations, monitoring and trending performance.

A programme of field inspection tours by managers and supervisors was initiated in 1998. These tours initially focused on housekeeping and material condition but were later also focused on industrial safety. It is recognized that the plant undertook a significant and positive initiative with these inspections. Management and supervisory field presence is considered an essential element in providing positive feedback to staff and for ensuring that performance standards are being met and improved where required. This programme has not yet been sufficiently effective in bringing about the desired improvements in several areas such as industrial safety, radiation protection practices, maintenance work practices and material condition. The team recommended that the field tour programme be strengthened and supported by training and coaching. The team noted that the plant had identified that additional training was required.

1.3. QUALITY ASSURANCE PROGRAMME

The QA Manual was extensively revised in 1995/1996 to reduce the size and improve the usability. It consists of six chapters and contains both organizational documents and application documents which are written in a standardized format. This manual is specific to Bugey but is linked to corporate QA requirements. The QA Manual is controlled by the safety and quality department and has been made available electronically on the network.

The Safety Quality Manager reports directly to the Plant Director. He is not completely independent of the line organization, because he is also responsible for the radiation protection department.

An audit process and schedule has been established and plant management, including the Plant Director, reviews the results at the plant technical safety committee (GTS) meeting. The audit process is revised if necessary as a result of this review.

Although there is an established basis for the audit programme, it has not been completely successful in identifying the extent of the deficiencies in areas such as the industrial safety and radiation protection programmes. The team has therefore suggested that QA programme be strengthened and consideration should be given to utilizing more frequent but shorter surveillance's which are specifically focused on the plant programmes that are in most need of improvement. The senior management committee should consider more frequent reviews of the results.

1.4. REGULATORY AND OTHER STATUTORY REQUIREMENTS

The regulation by the safety authorities of the plants operated by EDF is carried out by several government bodies but the principle nuclear safety authority is DSIN which sets national nuclear safety policy and standards which apply to all EDF plants. The DSIN reports to the Ministry for Industry and the Ministry for Environment at a national level. The DSIN also approves the technical specifications, surveillance tests, operating rules and emergency arrangements. A regional department of the safety authority (DRIRE) carries out the inspection programme and enforcement regime. In addition, technical support for safety assessments and development of assessment methods is performed by the safety authority's corporate support (IPSN). The interfaces with the safety authority are well defined and the Safety and Quality Manager is responsible for all interfaces. Single points of contact are established for inspections during operation and during outages.

At the local level, the DRIRE has responsibility for the Rhone Alpes region, which includes Bugey. The DRIRE is responsible for both nuclear and non-nuclear facilities. Fifteen inspectors are located in nearby Lyon and two are assigned to Bugey. Communications between DRIRE and Bugey appear to be open and sincere.

The safety authority has an annual inspection programme which includes about 20 inspections per year, some of which are unannounced inspections. The frequency of inspections is increased during outages. The local inspectors indicated that plant inspections are being increased with additional focus on the quality of field work activities.

1.5. INDUSTRIAL SAFETY PROGRAMME

An industrial safety quality policy has been established, which is based on two principles, "safety issues will always prevail over production demand" and "success depends on the commitment and competence of directors, managerial staff and the members of the staff".

Safe work practices are specified in an integrated, well presented booklet of rules covering many potential hazards in the plant. This booklet contains a memo signed by the Plant Director which states that "industrial safety is a major goal of our enterprise". This booklet also identifies all required personal protective equipment to protect workers from hazards, which cannot be isolated or eliminated. e.g. hard hats, safety glasses, protective clothing and hearing protection. Some areas of the plant are posted with signs which indicate obligatory personal protective equipment while others are not. These requirements are not always followed by plant staff or by contractors.

Lost time accident statistics for both EDF staff and contractors has shown no significant improvement over 1997 and 1998 and are significantly higher than seen at the best performing plants. In 1998, the number of lost time accidents for EDF staff was 13 and 40 for contractors for a total of 53. This results in a combined accident rate of 10.6 per million person-hours worked.

This is significantly above the industry best practice, where many plants are achieving results that are <2.3 per million person-hours.

In the first two months of 1999, there has been a deteriorating trend with a total of 8 lost time accidents for EDF staff. This is of concern in that there is no significant improvement in the lost time accident rate and this could lead to more serious injuries.

Plant management is aware of the concern and on March 1, 1999, the Plant Director issued a letter to his direct reports to stress that improvements must be made and that additional actions are required which must be included in management contracts. This memo also highlighted the need for improved contractor performance. A meeting, chaired by the deputy plant manager, was subsequently held with senior officials of several contractors. They were asked to present their accident statistics and action plans to improve their industrial safety performance.

The analysis of industrial accidents is reactive by reviewing accidents, whereas the best performing plants use a comprehensive "near-miss" reporting system that is proactive.

The team has recommended that the plant should review its industrial safety programme and make improvements in this area.

1.6 DOCUMENT AND RECORDS MANAGEMENT

The responsibility for document control is centralized with the Plant Information Systems Department which distributes reference documents to satellite holders within other departments. The plant has decided to computerize its commonly used and most significant technical documents in order to have them readably available to plant staff. The conversion started in 1996 with the integration of SMISS diagrams (mechanical drawings). In 1998, the maintenance working procedures (approximately 4,500), surveillance and post-maintenance testing were added. The Technical Specifications for Operations are currently being computerized, as are alarm data sheets.

The computerized technical documentation reference system fully lists the various categories of technical documents in the areas of maintenance, operations and engineering. For each category, the system indicates the department owner, the status of the document, the duration for archiving, and the location where it can be consulted.

STATUS AT OSART FOLLOW-UP VISIT

In general, good progress has been made on the Management, Organisation and Administration issues. Of the four recommendations, one recommendation was found to be resolved, two recommendations have made satisfactory progress and one recommendation was found to have made insufficient progress. The suggestion in this area has made satisfactory progress.

The issue concerning communication of management expectations has resulted in analysis of root causes and defining actions to resolve these causes. Several initiatives have recently been implemented and some positive improvements were identified. Areas of improvement include housekeeping, control of lifting equipment, revision of operational procedures and enhanced management support to radiation protection activities. The issue was found to have made insufficient progress because there is still a need to: set milestones for implementing improvements, strengthen the link to a vision of what to achieve, and improve the monitoring process. Senior management and management/supervisor staff should continue to reinforce, on a more day to day basis, their expectations in areas such as industrial safety, material condition and where cultural changes are needed This daily reinforcement will be most effective in it is done in the field.

The issue concerning alcohol consumption was found to be resolved. The plant has strictly forbidden consumption of alcohol on site and revised their internal rules indicating that noo exceptions will be tolerated and actions will be taken for those not respecting the rules. Prohibition of other drugs was already included in the internal rules before this revision.

One issue related to management tours has made satisfactory progress as several weekly tours have been implemented with participation of senior management, department managers and industrial safety engineers. Training has been given to managers/supervisors on how to perform these tours. However, senior management's possibilities to cover the whole plant in a reasonable time frame and identify all issues could be questioned. Measures to evaluate the effectiveness of the plant's tour program need to be implemented.

Plant management has demonstrated a significant commitment to the radiation protection programme and has taken actions to elevate its importance to the same level as nuclear safety. Several communication initiatives have been taken to convey consistent industrial safety messages. The issue was found to have made satisfactory progress due to these activities. However, in order to get a change in this area senior management and management/supervisor staff need to continue to communicate their expectations and follow-up the status of progress, preferably in the field,.

The suggestion concerning internal auditing and self-assessment was found to made satisfactory progress as several initiatives have been taken to improve the auditing program and the way of doing self-assessments. The actions taken are appropriate and ambitious.

DETAILED MANAGEMENT, ORGANIZATION AND ADMINISTRATION FINDINGS

1.1. CORPORATE ORGANIZATION AND ADMINISTRATION

1.1(1) Issue: Plant management has not established or effectively communicated clear expectations for safe operational performance in several areas**.** This sometimes results in EDF and contractor worker performance that does not meet industry standards. When questioned, several plant staff indicated that plant policy documents are not sufficiently definitive.

The following examples indicate the need for more definitive expectations:

- In some cases, industrial safety policies have not been established which clearly define the expectations such as some areas where smoking should be prohibited and where hearing protection should be used when the noise levels exceed 85dBa. In other cases, expected safety practices/policies have not been clearly communicated, understood or reinforced such as not climbing on equipment to perform work.

- The requirements for use of the foot monitors and the small object monitors at the exit of the Auxiliary Building have not been specified. As a result many staff are not monitoring their feet or hand held items for radioactive contamination.

- Detailed requirements for the use of “3 way communications”, “self check” and procedure use and compliance have not been specified for operations staff. As a result, there is an increased potential for events caused by human error.

- Clear expectations have not been established for the trending of important parameters in several areas such as chemistry, radiation protection and low-level events.

- Specific requirements for operator rounds have not been established to ensure a high standard of equipment monitoring and identification of defective or degraded equipment.

- There is no policy that specifies the expectation that “on-call” plant staff must not consume alcohol.

- There is no policy that defines the requirements for reporting low-level events. As a result, plant staff are not always capturing low level events. Current industry practice indicates that the recording, trending and analyzing low-level events is necessary to identify precursors to more serious events.

- The requirements for foreign material exclusion have not been clearly established in some areas such as around the spent fuel pool and during maintenance activities. As a result, there is an increased potential for the entry of undesirable materials into the fuel pools and other plant systems.

- There is a lack of clear expectations for the exclusion of wood from the RCA. A significant quantity of wood is currently present in this area which does increase radioactive waste and fire loading.

- There is a lack of clear expectations for the use of safety tape. This tape is sometimes used to rope off large areas of the plant where work is in progress. Some staff do not enter these areas to perform essential duties such as operator rounds, while others were observed entering the area.

- The expectations for “Area Responsibilities” are not sufficiently defined to ensure a high standard of housekeeping and material condition.

Industry experience indicates that the lack of clear expectations can lead to degraded performance, personnel injuries and significant plant events.

Recommendation: Management should systematically establish and effectively communicate their expectations including creating or revising documentation where it may be useful. These expectations should be monitored, trended and enforced to ensure the achievement of a consistent high standard of safety performance.

Plant response/action (response given by: J.F. NICAISE)

After analysing all the conclusions made during the OSART mission in March 1999, - that recommended us, among other points, to focus our efforts on clearly defining our expectations, making sure they are applied, and improving our practices in the area of industrial safety and radiation protection – plant management modified its plant strategic plan (PSU) by incorporating its new priorities: **industrial safety and radiation protection**. To make this happen, plant management set up two projects: the industrial safety/plant housekeeping project and the radiological cleanliness/radiation protection project.

To deal with the point concerning communicating our expectations, plant management decided to make better use of the support of the line management department heads, by increasing the frequency of meetings between the two: since the beginning of the year 2000, meetings have taken place every fortnight. These meetings allow us to express our expectations and to make sure that they are understood and applied.

Plant management also uses other ways of communicating its expectations:

– At the end of 1999, we organised a series of 8 meetings to present the new plant strategic plan to all plant personnel. During these meetings, we clearly demonstrated that the priority for the year 2000 was **industrial safety**.

– We made sure that these expectations were taken into account via the management contracts drawn up with the department managers.

– Plant management displayed the priority given to industrial safety at the entrance to the plant.

– Safety and Q.A. requirements are clearly explained in the plant's Q.A. manual. Using the now-reinforced self-evaluation audit programme enables improved communication of these requirements to plant personnel.

Some examples of standards of expectations being set by plant management are:

– Industrial safety rules have been clearly laid down for all plant personnel in a document reminding them of basic safety rules. Every worker (from the plant and from contractors) will make a formal commitment to adhere to these rules (by signing a document). Plant management has specifically pointed out that smoking is forbidden in all 'industrial' plant buildings and that the wearing of personal protection is mandatory. Currently, this document is being distributed and explained to plant personnel by their department managers.

– Rules for exiting the radiologically-controlled area (RCA) have been defined and displayed in the changing rooms. These deal especially with the rules concerning the use of both hand/feet friskers and detection equipment for small objects.

– Plant management has requested the department managers concerned to trend parameters as of March 2000 in the areas of chemistry, radiation protection and industrial safety. A performance monitoring panel for industrial safety and radiation protection has been set up with results being updated on a weekly basis. This enables plant management and line department managers to monitor such parameters as the number of working accidents, radiation exposure of personnel, triggering of alarms on RCA exit portals, contamination events, etc. Analysing these results also makes it possible for department managers to implement corrective actions if needed.

– The forbidding of alcohol on the plant is now a rule that is understood by the personnel. It will be clearly stated in the internal plant regulations. (see recommendation 1.1(2))

– A foreign material exclusion zone has been defined for around the spent fuel pools (fuel buildings) and reactor cavity pools (reactor buildings): the rules to be applied for avoiding foreign material inclusion are displayed in the relevant areas.

– Plant management has decided to eliminate the use of wood for scaffolding within the RCA. This action spans a four year period, all wooden scaffolding will have disappeared from the RCA by 2003. During the year 2000, wood will be eliminated on unit 4.

IAEA comments

The plant has done a thorough analysis of the root causes of issues identified during the OSART mission resulting in 110 actions where the plant management established written expectations. Above all, plant management has given the highest priority to industrial safety and radiation protection for the year 2000. The strategic plan has been revised to show this. In some instances, the expectations have been communicated to the departments concerned and included in the management contracts of the department heads. As an example the department head for Fuel and Logistic presented how he had further communicated these expectations in his department and the actions taken. However, in general, the team felt that management had not done enough to personally communicate their expectations to all staff in such a way that positive results are achieved.

To focus on top priorities, the plant management has set up two projects, one for improving industrial safety/house-keeping and one for radiation protection/radiological cleanliness.

Several of the initiatives taken to meet the expectations of the plant management have recently been implemented and some positive improvements since the OSART mission were identified. Areas of improvement include housekeeping, control of lifting devices and ladders, revision of operational procedures and enhanced management support for radiation protection activities.

Management expectations were not met in several areas. These areas include contractor accident rates, leakage from plant equipment, material condition, and the quality of communications in simulator training. Greater management attention is necessary to assure that desired improvements are realized. Increasing the number, and quality, of management and supervisory field observations will assist with this effort. The program for field observations should be well coordinated so that from time to time all areas and activities are observed.

Additionally, the team found that some of the specified actions from the plant management expectations were missing targets in time and the expectations/actions were not linked into a vision of what was to be achieved. Examples of these areas are; temporary modifications, personal exposures, and plant labeling. Monitoring should be strengthened by using numerical goals and measuring performance against these goals. Achieving the desired results is dependent on having clear performance goals and specific time frames for achieving these goals.

To ensure progress in areas of industrial safety, material condition and areas of cultural changes a continuous reinforcing of messages have to be done by the senior management and management/supervisor staff more on day to day basis in the field. Without this it will be difficult to reach effective results in consistent achievement of high standards of safety performance. Greater overall management presence in the field communicating the expectations is needed to accomplish this objective.

Conclusion: Insufficient progress up to date.

1.1(2) Issue: The station does not have a comprehensive strategy or policy that prohibits the consumption of alcohol prior to work or during the workday, including on site**.** It is recognized that the station has taken steps to restrict the consumption of alcohol to small quantities during the lunch period. On site, wine and beer is available in limited quantities to control room staff and to other plant staff and contractors from the canteens. In addition, the plant does not have a "fitness for duty" policy for on-call staff that addresses the prohibition of alcohol.

Fitness for duty in all aspects, of which alcohol is one of the aspects, is an essential element in nuclear plant operation and in overall plant and personnel safety. International experience indicates that the availability of alcohol on site should be strictly prohibited.

Recommendation: Management should establish and develop a strategy regarding the consumption of alcohol prior to and during work which will lead to the prohibition of alcohol consumption on site. The experience of other EDF plants with more restrictive practices could be helpful in compiling this strategy.

Plant response (response given by: J.F. NICAISE)

Plant management has decided to prohibit all alcohol consumption at the plant, thereby going a step further than the French legislation, which tolerates a limited consumption when and where meals are taken. So far, this was the rule that had been applied at the plant.

The decision on the prohibition of alcohol was made in January 2000 upon a proposal made by the industrial safety and housekeeping project team. Plant management informed the plant staff representatives on 14 January, 2000.

This new rule will be integrated into the plant internal rules and applied as of May 2000, which is the time necessary to amend the document according to EDF's administrative procedures and French labor law.

The current situation is as follows:

- No staff member may bring alcoholic beverages to the plant. Compliance with this rule is checked by security staff with the X-ray monitors installed at the plant entrance;
- Until the plant internal rules are modified accordingly, the consumption of wine or beer at lunch time will still be allowed at the plant restaurant in limited quantities;
- Plant management no longer authorizes the consumption of alcoholic beverages in the restaurant reserved to plant guests.

As to the consumption of alcoholic beverages before taking up work, team managers and foremen are to withhold any plant employee from their workstation if their behavior is abnormal, for whatever reason (alcohol, drugs, medication, etc.).

IAEA comments

The “Internal Rules for Bugey NPP” (D5110/NS/93009) have been changed to strictly forbid consumption of alcohol at the site. No exceptions are tolerated and actions will be taken for those not respecting the rules. Alcoholic beverages are no longer available in the restaurants at site and all personnel, Edf staff as well as contractors, are checked by security staff when entering the plant. The revised internal rules are valid from May 15, 2000. Prohibition of other drugs was already included before this revision of the rules. The internal rules also cover contractors.

Conclusion: Issue resolved.

1.2. PLANT ORGANIZATION AND MANAGEMENT

1.2(1) Issue: Management and supervisor "Green Helmet" safety tours or "Work site Audits" have not been sufficiently effective in bringing about the needed improvements in human performance and material condition. While improvements have been realized through this programme, additional efforts are necessary in identifying and correcting deficiencies such as industrial safety, radiological protection practices, maintenance work practices, material condition and housekeeping in some areas.

It is recognized that the plant undertook a significant and positive initiative with these inspections that were started in 1998 to provide additional focus on safety and job site practices.

While the station has established general policies for these tours, there are no specific guidelines for the conduct and content and follow-up of the reviews. In addition, plant management has identified that sufficient observation training and coaching was not provided for this important plant programme. Development of this training is in the conceptual stage.

International practice is to clearly define the objectives for this type of programme, develop and deliver structured training and implement a qualification and coaching programme. This includes ensuring that there is a clear understanding of the expected high standards and methods of enforcement.

Ineffective management tours can impact the ability for continued performance improvements or lead to deteriorating human performance and resulting plant events.

Recommendation: Guidelines should be implemented for the conduct of field tours. A comprehensive training programme should be established to instruct and coach staff on the techniques and practices required to make these field tours more effective. Plant management should implement a method of measuring the effectiveness of the field tour programme.

Plant response (response given by: J.F. NICAISE)

A training programme has been set up so as to improve the efficiency and effectiveness of plant field tours. The plant got in contact with a training company specialised and competent in this area. 20 training sessions were scheduled to take place between Nov. 1999 and Apr. 2000. By this date, 180 managers (department managers, engineers, foremen) will have had this training.

Department members now go on industrial safety tours of their own worksites, applying the methods taught during their training. This activity is a formal request by plant management to department managers as part of their department management contract. As of 15th March 2000, the various departments of the plant had gone on 23 industrial safety tours.

The organisation for measuring the effectiveness of these tours and reporting to plant management is currently being drawn up. It should be finalised by the end of May 2000.

IAEA comments

Plant management has established different tours to control the status of the plant and to communicate their expectations including :

- Weekly tours, where senior plant management takes part, to follow up on issues identified by the Industrial Safety and Housekeeping project;

- Department management industrial safety tours to evaluate specific work sites in areas where they have responsibilities;

- Tours by the Industrial Safety Engineer;

- Weekly tours by safety engineers to examine the compliance of operational safety requirements. These tours are planned in a way that the whole plants operational equipment will be covered during one year.

To support the performance of these tours a comprehensive training program has been established to instruct and coach staff on the techniques and practices required to make these field tours more effective.

Each of the tours provide elements that are valuable to plant management in getting a global picture of the status of the plant. However, the above mentioned tours are not coordinated and the coverage of the whole plant during the year could be questioned as well. With the limited number of tours it may not be possible for individuals of senior management to cover the whole plant and identify all issues during a time frame of one year. The effectiveness of department management industrial safety tours could also be questioned as only few (1-3) observations were noted for each tour.

The team suggests that plant management go further with the implementation of the methods to measure the effectiveness of their field tour program and evaluate the plant management's coverage's of plant areas.

Conclusion: Satisfactory progress up to date.

1.3. QUALITY ASSURANCE PROGRAMME

1.3(1) Issue: The site Quality Assurance and Self-Assessment surveillance programmes are not always sufficiently comprehensive to provide the department managers and the site director with an adequate assessment of the status of significant plant issues**.**

It is recognized that plant management has undertaken a significant initiative to introduce a self-assessment process in many plant departments. Plant management recognizes the importance of this programme in their goal to improve plant safety performance.

Some examples of programme deficiencies are detailed below:

- The Safety Quality Department (MSQ) audits have not identified deficiencies in radiation protection contamination control practices by station staff and contractors such as those listed in the radiation protection portion of this report. They have also not identified the extent of deficient industrial safety practices and conditions such as listed in this report.
- The maintenance self-assessment programme has not identified many of the issues as identified in this report, such as poor conventional and radiological work practices.
- The operations self-assessment programme has not identified many of the issues as identified in the operations section of this report, such as weaknesses in operator rounds, use of check sheets and plant status control.
- The results of the self-assessment programmes in some departments such as operations and maintenance are not periodically reviewed to identify adverse performance trends or to identify common human factor issues.
- A monitoring and trending method has not been developed to provide the plant director with a quantitative assessment of an improving or deteriorating trend.

An ineffective QA and Self-Assessment programme can lead to unidentified issues and resulting degraded plant performance.

Suggestion: Management should consider implementing measures to strengthen the Quality Assurance audit programme and Self-Assessment programme. Consideration should be given to utilizing more frequent and shorter surveillance audits, which are focused on significant plant issues. Department heads and the senior management committee should review the results on a more frequent basis to provide earlier detection of deteriorating trends in safety performance or human behaviors.

Plant response (response given by: J.F. NICAISE)

Plant management has decided to reinforce auditing, quality assurance and self assessment programmes, which means that the auditing programme for 2000 is broader in scope and more intensive. This programme includes:

- 82 self-assessment audits,
- 54 quality assurance audits.

New independent checking practices have been added to this programme, namely:

- In-the field nuclear safety tours by safety engineers (once a week).
- Periodic meetings (every fortnight since September 1999) between auditors of the safety & quality department and representatives of the fuel, logistics, civil works and industrial safety & radiation protection departments. During these meetings, the processing of deviations related to radiological cleanliness and radioactive fuel transportation is listed and reviewed.
- Independent checks in the field during outages. In 2000, they will involve four priority areas: radiation protection, organisation, deviations, spare parts.

The reporting to plant management and dept. managers on self-assessment audits is done every month. Every quarter, the engineer in charge of the self-assessment process presents the status of the auditing programme to senior management teams from the main plant groups. A similar reporting system is planned for quality assurance audits.

IAEA comments

Plant management has initiated several changes in their internal auditing and self-assessment programs since the beginning of the year 2000. The auditing program has drastically changed so it is now covering the specific functional themes of the organization in a two year cycle. The way of performing audits has changed to be more effective with broader involvement of the departments concerned in resolving identified issues. Communication between departments has been strengthening through meeting every second week. A summary report on progress is provided monthly.

The self-assessment program has been reinforced and coordinated in such a way that each department identifies important areas to assess. The departments perform their self-assessments in a structured way and report findings categorized in internal and transversal (cross functional) categories. Actions to cross functional findings are coordinated by the safety and quality department.

The team found the actions taken appropriate and ambitious, but the time period since implementation is too short to judge its success. The team suggests that by the end of 2000 an evaluation be performed of the new approach's effectiveness to enhance continuous improvement.

Conclusion: Satisfactory progress to date.

1.5. INDUSTRIAL SAFETY PROGRAMME

1.5 (1) Issue: The industrial safety programme is not always effective in identifying, correcting and preventing many potentially unsafe conditions and practices in the plant. These conditions and practices are present even though plant management has implemented an extensive plant safety inspection programme. In addition, some plant safety policies are not sufficiently comprehensive or widely understood to ensure the safety of plant personnel and equipment.

The plants' industrial safety performance record has been significantly below average. The 1998 lost time accident rate was 5.8 per million person-hours for Bugey EDF staff which is more than twice the WANO target of <2.3. 1999 performance indicates a deteriorating trend with eight lost time accidents for EDF staff in the first two months of 1999 compared to one in the first two months of 1998.

The average accident rate for contractors was 30.1. One contractor who provides services to Bugey has an accident rate of 80. It is recognized that Bugey management has recently taken action with senior contractor officials to identify their concerns with contractor safety performance and to request improvement action plans.

Many examples of poor working practices by EDF and contractor staff were noted including:

- Workers not wearing appropriate safety equipment (such as hard hats, hearing protection, safety glasses, gloves and goggles).
- A worker was working near acid pumps without the required safety goggles. Another worker was grinding without safety glasses. Two workers using a large sledgehammer were not wearing safety glasses. A worker was using a chisel and small sledge hammer without safety glasses There were 39 recorded instances of eye injuries in 1998.
- An instructor was not wearing a hard hat while in the plant with 15 students who were wearing hard hats.
- A worker was standing on a desk chair with wheels to perform maintenance.
- Working at heights without safety harnesses. For example a worker was straddling between the top of a pump motor and an adjacent fixed ladder. There was a drop of ~3m.
- Arc flash prevention curtains were not used during welding operations.

– A worker was observed smoking near a hydrogen filled generator.

– An electric space heater had been placed near open cans of paint and solvent.

Several industrial safety hazards were also noted, including many tripping hazards, unsecured gas bottles, slipping hazards, uninsulated piping, unsecured scaffold planks, an exposed light socket in area of the hydrogen cooling system and access to unmarked hazardous chemicals.

It is noted that the plant has recently made several industrial safety improvements such as the provision of permanent access ladders, platforms, safety gates and lifting devices.

In some cases, safety policies have not been established which clearly define the expectations such as some areas where smoking should be prohibited and where hearing protection should be used when the noise levels exceed 85dBa. In other cases, expected safety practices/policies have not been clearly communicated, understood or reinforced such as climbing on equipment to perform work.

Insufficient attention to industrial safety can lead to degraded accident prevention barriers and more serious accidents could result. Experience shows that managers supporting a vigorous in the field programme with regular refresher training for workers does improve accident statistics.

Recommendation: Management should establish, clearly communicate and enforce higher standards for industrial safety. Managers and supervisors should receive training in necessary industrial safety practices and surveillance activities so as to be able to recognize and correct real and potential hazards in the field.

Plant response (response given by: J.F. NICAISE)

In order to improve plant performance in the area of industrial safety, plant management has made a certain number of decisions:

– In September 1999, an "industrial safety engineer" has been appointed, whose mission is to be mostly in the field. During his tours, he ensures that industrial safety rules are correctly applied and reinforces them with the staff when necessary. This engineer is also in charge of reporting to plant management on matters relating to industrial safety.

– Plant management has strengthened the position of the industrial safety and radiation protection department, in particular its "engineering section". Five technicians and three engineers were recruited in 1999. The target is to reinforce the presence in the field of industrial safety and radiation protection staff. These staff members are also trained in plant condition and observation techniques in the area of industrial safety.

– The plant strategic plan has been complemented by an "industrial safety and plant housekeeping project" whose main actions include the following:
– clarification of industrial safety rules,
– enhanced management presence in the field,
– training of line managers in industrial safety tours,
– improving plant condition and housekeeping.

All these actions are currently under way.

– Fundamental industrial safety rules have been clearly identified and detailed such as for instance the "alcohol policy" (see recommendation 1.1(2)) and "smoking policy". Some of these rules are displayed in the field (smoking policy, wearing a visible badge, wearing individual protective equipment, procedure for entering and exiting the radiation controlled area, etc.). The staff were informed about these rules by their department managers. A booklet has been printed for all plant employees and contractors. Plant management has also decided to include these rules in a document that the staff will undertake to adhere to. They formally pledge to adhere to the rules by signing the document.

– Creation of a work-site training facility (currently under construction and operational as of May 2000): this facility will be used for practical training of the staff in industrial safety and radiation protection professional techniques for use in the field.

IAEA comments

The plant has strengthened the position of the Industrial Safety and Radiation Protection department by recruiting new personnel in 1999 with the target to reinforce the presence in the field of industrial safety and radiation protection personnel.

Communication of industrial safety messages has been strengthening through several initiatives including:

– plant manager presenting his expectations for all staff;

– posters conveying consistent industrial safety messages;

– industrial safety engineer tours;

– weekly statistical report is established and distributed to each department head;

– distributing a monthly industrial safety and radiation protection report.

Furthermore, training to do field inspections is provided for managers and supervisors. A work site training facility is under construction in the unit 1, where initial and refresher training will be provided on how to enter the RCA, contamination control and how to set up work sites.

Procedures for reporting and analyzing industrial safety accidents have been revised and now include minor accidents with no external medical treatment and sick leave. Analysis of common causes are done and actions taken to communicate these to the plant management and the different departments. All accident reports are communicated to the departments and were also found posted in the various plant locations.

However, the team found that several of the above mentioned good initiatives have been implemented recently or will be implemented in the near future. In addition there are no signs of that the contractors accident rate is decreasing. Senior management and management/supervisor staff have to continue to communicate their expectations and follow up status of progress, preferably in the field on a day to day basis, to get change in this area.

Conclusion: Satisfactory progress to date.

2. TRAINING AND QUALIFICATION

2.1. ORGANIZATION AND FUNCTIONS

Bugey NPP uses the EDF-wide system of training which is based upon the establishment of a competency-based Standard Training Plan (PTF) for each job function and an Individual Training Plan (PIF) for each person, which tailors the PTF based upon the individual's previous experience, training and education. This training system is coupled with a formal qualification (authorization) system, which provides for a review, by each person's manager, to confirm completion of all required training, and a joint agreement between the employee and the manager. This joint agreement signifies that the employee acknowledges his responsibilities associated with the qualification and that the manager is satisfied that the individual is capable of performing his assigned tasks without special supervision. The formal authorization is then made by a higher level line manager who has been delegated this authority by the plant director. This system also requires an annual performance appraisal which includes an assessment of performance and identification of training needs, as well as a re-authorization. This re-authorization has focused on nuclear safety, industrial safety, radiation protection, and quality, but not on job-specific skills. There are efforts underway to include job-specific skills in this re-authorization process, however, to date this process has primarily focused on selection of job-related training courses, and, in most cases, has not included job-specific practical training and associated assessments to ensure that personnel maintain their skills at appropriate levels of performance. A recommendation was provided to improve this area.

EDF has in the past emphasized central control of training and qualification programmes. However, there has been an increasing recognition of the importance of site and individual manager "ownership" of and responsibility for the training and qualification programmes and performance of their personnel. Consequently there has been a focus on the sites being the clients for training and the Professional Training Department (SFP) being a provider of services to the sites/departments. The Bugey Plant Training Manager and individual department managers "pay" for the services of the SFP and are permitted to select outside vendors for training services, even if these services are available through SFP. This was viewed by the team as a positive development. However, based upon observations during the review, there are still improvements needed in resolving potential conflicts of interest between SFP roles in establishing consistent standards of training quality and monitoring this quality, while at the same time being a provider of training services that are being monitored.

In addition to corporate oversight of training, the principal mechanism that is used to provide consistent standards for training at Bugey is the Training Committee, chaired by the Deputy Plant Director. This committee approves the Training Plan that is prepared by the Plant Training Manager each year based upon inputs from all organizational unit managers. This plan is used as the basis for developing the SFP training budget/plan to support Bugey, as well as the budget for site training activities. The Training Committee also reviews training results. The principal focus of this review is on the number of hours of training courses and the budget and finances for training, not on the quality of training. No statistics are kept as to time spent in practical training or the quality of this training, which is a possible indicator that such training is not valued as much as formal training courses. The team suggested that the site improve the evaluation of the effectiveness of training programmes including evaluating the relationships between training programme results and the organization's goals and objectives.

Bugey is one of the oldest EDF NPPs, and thus will be one of the first to undergo the process of replacing experienced personnel due to retirement. Discussions with the Plant Director indicated that there were plans in place to deal with retirement of significant numbers of Bugey plant staff, but this issue is not yet addressed in the 2000 Plant Training Plan. Due to the long lead times needed to recruit, train and authorize plant personnel, it is important to plan well in advance for their replacement.

2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

The Bugey training facilities and equipment benefit from the advantages of a large number of standard NPP units within EDF. The combination of training facilities, simulators and mockups available to Bugey are among the best in the world. Bugey also benefits from the regional EDF training center for a number of EDF NPPs being located on-site. In addition, within a two hour drive of Bugey are other EDF training facilities, including the CETIC center for fuel handling, and the La Perolliere maintenance training center. The Bugey full-scope simulator was recently upgraded to current international standards. It is not presently housed in a facility that allows for the same layout as in the Bugey control room, but that situation is expected to be corrected later this year.

The SFP training center located at Bugey provides a combination of functional, multifunction, accident, and full-scope simulators for the training of plant operations, maintenance and technical support personnel. The SIPACT accident analysis simulator was put into operation at Bugey in 1997, it provides an outstanding tool in training control room operators, supervisors and teams in understanding the thermo-hydraulics of transient and accident conditions. It's use was identified as a good practice by the team.

Bugey also makes good use of mockups of plant equipment for particularly important, difficult or infrequently performed tasks such as steam generator nozzle dam installation, fuel handling, and vessel head removal and installation. The team observed effective use of these mockups to prepare both plant and contractor personnel for an outage that began during the mission.

In general, training materials are of high quality for training provided by SFP and the site. The structure and organization of training materials for practical training and shadow training was generally not of the same high quality as for classroom or theoretical training. As practical/shadow training is often provided by part-time instructors, the structure and quality of these materials is particularly important.

2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

Bugey has a policy of rotating many personnel, such as Shift Operations Managers (SOM), at five year intervals. This creates a greater need for initial training programmes than at many mature plants in other countries. There are currently nine individuals in the control room operator training programme, for example. The classroom, simulator and theory training is provided by SFP, while the practical/shadow training is provided by the site. The initial training programme for control room operators and shift supervisors is comprehensive. The instructors who provide this training have both the appropriate technical knowledge and have completed a comprehensive instructor training programme.

Seven control room crews have been established in order that control room operators and supervisors can be provided six weeks of training per year, two of which are conducted on the full scope simulator (one week every six months).

The team observed the conduct and debriefing of two refresher team training scenarios on the full scope simulator. There were many positive aspects of the training, including the design of the simulator instructor stations, and the video and audio equipment. Another positive aspect was the open, interactive nature of the debriefing sessions in which all of the shift team and the instructors actively participated. However, the team did provide recommendations for improvement, including use of more structured evaluation tools based upon specific learning objectives, enforcement of formal operational communication standards, and more frequent observation of shift crew performance in the simulator by plant managers.

One of the principal focuses of refresher training in 1999 will be on preparation for a change in 2000 to symptom (state) based emergency operating procedures (EOPs). It is felt by the team that the SIPACT simulator will be an important tool in preparing the crews for this change.

2.4. FIELD OPERATORS

The Bugey Operations Department has put considerable effort in the recent past in improving the field operator initial training programme. From 6-12 trainees per year are participating in the programme, including some who will be assigned to other EDF plants. The classroom portions of the course are guided by specific learning objectives and quality training materials. However, the practical and shadow training portions of the training programme do not have a similar level of learning objectives or structure. The team recommended that both the trainees and the shadow trainees could significantly benefit from additional expectations as to what is to be accomplished during this training. A field staff working group has been established to ensure that training needs are effectively identified by job incumbents and that they are appropriately addressed. This was viewed by both the field operators and by the team as a positive aspect of the training programme. The use of such working groups might be a beneficial improvement for use site-wide.

2.5. MAINTENANCE PERSONNEL

As with other Bugey organizations, maintenance managers demonstrated significant knowledge of and interest in the training and qualification of their personnel. Considerable efforts have been devoted during the past two years to improvements in these programmes. Several of these improvements have focused on dealing with specific performance issues such as: valve training, use of radiation protection devices, writing of specifications for service providers and risk analysis. Another area of focus has been on improving the performance of outage teams. This effort was particularly noteworthy due to the structured needs analysis process that was used to identify the expected performance requirements and associated competencies through the use of a team of subject matter experts.

While considerable resources are devoted to refresher training for maintenance personnel (for example, for I&C technicians in 1998, 7.6% of their total work hours, on average, were devoted to participating in training courses), these efforts are not necessarily focused on maintaining or enhancing job performance.

2.6. TECHNICAL SUPPORT PERSONNEL

The same authorization and re-authorization system is used technical support job categories as is used for operations and maintenance personnel. Both the chemistry and tests organizations have focused their efforts to ensure that their training needs identification process focuses more specifically on job-related needs. One change that has been made in this regard is to provide greater involvement of foremen in the annual performance review process to improve identification of both individual and overall job performance weaknesses. There is still work to be done, particularly with respect to practical/shadow training, so that it is focused on ensuring that performance expectations are reached during initial training and that they are maintained through refresher training. Bugey devotes considerable resources to both formal training courses and to shadow training. Better definition of training needs and more structure of practical training has the potential to make more effective use of these resources, while at the same time finding ways to complete the training more efficiently.

2.7. MANAGEMENT PERSONNEL

The training and qualification programme for SOMs is comprehensive. It includes a 10 month EDF wide management and safety training course. Candidates for the programme are selected by an EDF corporate review board which has the positive effect of ensuring that Bugey and other sites are careful about who they propose. The 5-year rotation cycle for SOMs and safety engineers has the benefit of populating the ranks of most Bugey organizational units with managers who have a broad understanding of both the technology and the organization.

The management rounds programme has been implemented with limited success in identifying and correcting deficiencies. The plan for implementation of this programme did not include training for the participants in recognizing deficiencies. Discussion with the plant training manager indicated that during the most recent Training Committee meeting it was identified that training was needed in order for the participants in the management rounds programme to be effective, and that such training should be included in the 2000 Training Plan.

2.8. GENERAL EMPLOYEE TRAINING

EDF and Bugey devote considerable resources to general employee training in areas including industrial safety, nuclear safety, radiation protection, and quality assurance (in terms of hours of training the EDF requirements are among the highest in the international nuclear power community). In spite of this, the industrial safety and radiation protection performance of plant personnel and contractors is below the level of international standards in some areas. The team recognizes that these weaknesses are not necessarily due to a lack of knowledge and the team is not as well positioned to identify the root causes of these weaknesses as are Bugey and EDF managers. Discussions with personnel responsible for initial and refresher training in these areas indicated that they were not as familiar with recent plant incidents as would have been expected, and also that they were not able to clearly identify performance expectations (e.g., expected use of the foot monitors at the exit points from contamination control areas). Contractors generally do not participate in either initial training or refresher training provided in these areas by Bugey, but instead receive training from their own employers. EDF specifies what should be addressed in this training and periodically audits the training (this is consistent with French national regulations in this area). This system puts a burden on Bugey to establish additional mechanisms to ensure that contractors are aware of Bugey expectations concerning safety performance, special hazards in the Bugey workplace and also methods to ensure that contractors don’t bring with them equipment or materials that will create additional hazards/problems. The team recommended that improvements be made in these refresher training programmes.

STATUS AT OSART FOLLOW-UP VISIT

In general, very good progress has been made to resolve the training and qualification issues. Of the five recommendations, four were found to have been resolved and one was found to have made satisfactory progress. Of the two suggestions, one was found to have been resolved and one was found to have made satisfactory progress.

The plant has taken a structured, comprehensive approach to addressing all of the issues identified during the OSART mission. The Team had a positive impression that the Plant had taken ownership of these issues and understood the benefits to be realized through these improvements.

Good cooperation was demonstrated between the Operations Department and SFP in resolving issues related to simulator training. However, further cooperation and emphasis will be needed by both organizations if Bugey is to achieve its management expectations regarding 3-way communications in the control rooms.

Considerable improvements have been made in both the efficiency and effectiveness of practical training for field operators, instrumentation and control technicians, chemistry technicians and initial orientation training for new employees. Additionally, greater reliance is planned on practical training related to industrial safety and radiation protection through the nearly completed work site training facility.

Finally, the plant is encouraged to continue its efforts in evaluating the quality and effectiveness of training programs, particularly as they contribute to improving both individual and overall plant performance. In the future, a greater focus is given to reductions in the cost of electricity production, the tools to measure the value of training programmes in achieving plant performance goals will become more important.

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.1. ORGANIZATION AND FUNCTIONS

2.1(1) Issue: Overall training programme evaluation focuses primarily on the quantity of training and very little on its quality. The plant training manager is responsible for evaluating training effectiveness. A review of the most recent annual training evaluation report, prepared by the plant training manager, indicated that it focused almost exclusively on measures related to the number of hours of training and the numbers of courses, and not on the quality of the training. Discussions with SFP (Professional Training Department) personnel, with Bugey managers and instructors, and the Bugey Plant Training Manager indicated that there is not a comprehensive process of overall evaluation of the effectiveness of training. The plant is missing an important opportunity to identify measures that could enhance the quality of training programmes.

Suggestion: The plant should consider implementing methods to evaluate the quality/value of training provided, and integrating these methods into the plant training programmes, both at individual department and plant-wide levels.

Plant response (response given by: A. CHANTIOUX)

Regarding the evaluation of training quality, henceforth all the training courses are monitored with a feedback session in which a member of the trainees' management participates. The Professional Training Services then compile a feedback report on all the sessions, based on a model questionnaire, this indicates the degree of trainee satisfaction of the training objectives.

Concerning the effectiveness of the training courses themselves, as a performance element (added value), this is evaluated as part of experience feedback. This practice can be illustrated with some examples:

- For the outage specialisations: every year, refresher training is organised which especially concerns the points for which need for improvement has been identified.
- Operations specialisations: the points in which improvement is deemed necessary are identified through the training feedback reports, management observations in the field and on the simulator and the different specialisation groups (shift and field specialisations). These are then considered in the contents of training courses for skills upkeep. Measuring the effects of such or such training is generally planned in the training specifications and is correlated to the departmental performance indicators.
- Fuel shipment: the creation of a training course grouping all the participants together (fuel department and industrial safety & radiation protection department) has made it possible to regain the proper level of compliance with QA requirements and radiological

housekeeping for these activities. Between October 1999 and March 2000, no problems occurred in this area.

Industrial safety/radiation protection: training in industrial safety management plant tours that can improve site performance both for industrial safety, plant condition and housekeeping.

IAEA comments

The plant has taken an appropriate approach to address this issue. The most difficult aspects of measuring the quality of training are those related to its impact on job performance and plant performance, as many factors, in addition to training, have an influence. It was encouraging, in this regard, to see that the training initiatives developed in response to OSART findings and other recent sources have been put in place in the context of a larger overall program, rather than as stand alone activities. Examples are with respect to housekeeping, industrial safety and radiation protection.

The plant is encouraged to continue toward a more systematic approach to evaluating the quality of training programs, emphasizing its impacts on job performance and plant performance. This should be done both by individual departments and also at a plant wide level, in order to best apply lessons learned.

Conclusion: Satisfactory progress to date.

2.1(2) Issue: Job-specific refresher training programmes have not been sufficiently structured to ensure that plant personnel performance is maintained at required levels. The EDF-wide system of annual performance appraisal interviews and the use of individual training plans (CIF) and standard training plans is well established and consistently used as the basis for identifying refresher training needs that are the same for all or most plant personnel, such as nuclear safety, radiation protection, industrial safety and quality assurance. This system also identifies participants for established training courses, both job-specific courses and more general courses. This information is assembled by the Plant Training Manager for all departments and is included in the annual plant training plan. However, this method has not been effective in identifying job-specific training, particularly practical training, that is needed to maintain the job skills of authorized personnel at required levels. The following are examples of performance weaknesses that were determined to be, at least partially, the result of job-specific skill or knowledge weaknesses:

- Poor maintenance work practices;

- Material condition deficiencies not identified or corrected;

- Weaknesses in the conduct of operator rounds, equipment line ups and using checklists.

While it was not possible to review the training programmes of plant personnel in all job categories in order to develop a complete list of refresher training programmes that would benefit from additional structure, the following are examples:

- While considerable resources are devoted to refresher training for instrumentation and control (I&C) technicians (for example in 1998, 7.6 percent of their total work hours, on average, were devoted to participating in training courses), these efforts haven't necessarily been focused on maintaining or enhancing their job performance. In some cases, repeating initial training courses is used to provide refresher training, resulting in an inefficient use of resources and demotivation of personnel. For I&C technicians, considerable effort has been devoted within the past two years to provide an initial training and authorization system based upon the competencies needed for job performance. All technicians have completed their initial authorizations, thus the most important current need is to focus on the continuing/refresher training. A review of the refresher training programme indicated that it does not identify those job-specific performance areas where periodic training and assessment should be provided. Examples of such areas include tasks that are infrequently performed and changes in equipment and procedures.

- Considerable resources are devoted to refresher training for the chemistry unit. Greater than five percent of their total work hours, on average, were devoted in 1998 to participating in training courses with an even greater amount of time spent conducting shadow training. However, these efforts haven't been focused on maintaining or enhancing the job performance of chemistry technicians. The shadow training is not structured and organized to ensure that all tasks needed in a particular functional area are trained and evaluated in accordance with established standards. Rather, shadow training is specified in terms of time spent.

– Job-specific refresher training programmes have not been developed for radiation protection technicians to maintain their proficiency in performance of all assigned tasks, or in maintenance of supporting skills and knowledge concerning radiation protection theory and theory application.

Based upon the experience of other NPPs, through the use of specific shadow training requirements and monitoring of progress in achieving these requirements, it may be possible to reduce the time needed for shadow training while at the same time improving its consistency and quality.

Without refresher training that is based on job specific needs there are insufficient assurances that plant personnel continue to have the skills and knowledge needed to complete their work to required standards for nuclear safety and other criteria.

Recommendation: Develop and implement a plant-wide process to ensure that job-specific refresher training needs, particularly those for practical training, are identified and that a structured method is used to ensure that all authorized personnel are provided periodic training and assessment in these areas.

Plant response (response given by: A. CHANTIOUX)

Following the recommendation, several actions have been taken:

– Regarding the outage specialisations, since Autumn 1999, the plant has organised an annual refresher course inter-cycle. The refresher training programme is drawn up based on a self-assessment questionnaire for outage specialisations (survey of needs conducted with the line management departments and outage teams, based on performance). The opportunity for refresher training is grasped to assess the lessons to be drawn and measures taken in the previous fuel cycle as well as the objectives of the coming cycle.

– Since the beginning of the year 2000, the electricians and members of the industrial safety & radiation protection department conduct specific training courses and job specific refresher training (A659 and A660 for the electricity department and A628 for the industrial safety & radiation protection department).

– The I & C department has compiled an assessment of the skills available within the department (by profile). In addition, it draws up a chart of the target skills corresponding to the present needs and those for the time period of 2005/2010. It draws up its policy for acquisition and upkeep of skills based on training, situational training and shadow training. Regarding internal departmental training, this is based on the skills of highly qualified technicians and this is one of their tasks.

- The chemists now work on 2 levels:

  - Skills to be kept up to the level of the basic day to day activities: these are subject to an activities/skills/indicators description in wide areas. This document is a support for the foreman to plan and monitor employee by employee the actual training provided for skills upkeep (training courses or shadow training).

  - Key skills related to planned activities (oxygenation of the primary circuit for example): for this type of activity internal training is carried out just before the activity (just in time training).

IAEA comments

Job specific refresher training programmes for both chemistry, and instrumentation and control personnel were reviewed. In both cases, comprehensive refresher training programmes had been established with appropriate emphasis on maintaining and improving job competencies. These programmes were developed in such a way that both the needs of the organization to have a sufficient number of qualified personnel and the professional development needs of individual employees were considered. In both cases, there was evidence that line management had established ownership of the issue and had devoted the necessary resources and priorities to development and implementation of the programmes.

Conclusion: Issue resolved.

2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

2.3(1) Issue: Simulator training for shift crews is not provided with sufficient structure, objective evaluation or management oversight to ensure that the performance of all shift crews is maintained at consistent and high standards. Simulator exercises include neither specific measurable learning objectives nor evaluation criteria (standards) upon which to judge the successful completion of the training. Simulator training does not reinforce the use of internationally accepted standards for formal communication. In addition, plant managers outside of the shift crews who should provide operations oversight do not observe the conduct of simulator training (which is provided by the central EDF training organization, SFP) but instead this is the responsibility of shift operations managers (SOMs) for their crews.

The following are examples of situations noted during the observation of the conduct of simulator training for two shift crews:

- Prior to the observation of simulator team training exercises, the team requested copies of the exercise guide and evaluation criteria for the training that was scheduled. They were provided a handwritten sheet with information on the malfunctions that would be included in the scenario. This did not include learning objectives or evaluation criteria. The simulator training programme description does include training objectives but these are not translated into an objective guide that is used for evaluation of shift performance.

- The simulator instructors use a form to record observations that they want to discuss during the debriefing, but have no written criteria for evaluation. One simulator instructor had developed his own personal criteria for evaluating communications based upon a recently completed course on operational communications, but this was not used by other instructors. The Operations Department and SFP have not agreed upon a set of criteria for evaluation and observation of shift crew performance.

- In some cases, the SOM was involved in technical details rather than maintaining an overview of the evolution. No formal “time-outs” were used by shift supervision during exercises to make sure that the complete crew has a common understanding of the event.

- Debriefing sessions are held immediately following the exercise and involve the shift crew and both simulator instructors. Portions of one of these debriefings was observed. The session was conducted in a positive environment in which all of the shift crew participated in a critique and discussion of the scenario. Effective use was made of video tape and computer graphic displays of plant parameters during the simulator session to discuss the scenario. However, no objective assessment of the performance of either the team or individual shift members was made based upon expected standards of performance. Without assessments that are based on specific learning objectives and associated performance standards, there is insufficient assurances that the performance of all crews and individuals meet required standards.

- Operational communication deficiencies were observed during the exercise (compared to standards presented in the recent operational communications training, which are consistent with international standards). These standards recommend the use of repeat backs or 3-way communications to avoid errors caused by misunderstandings. There are no written standards for operational communications in the plant, although there was a recent training course held on this subject for all shift operations personnel. Informal communications contribute to human error, particularly in stressful situations such as in responding to abnormal or accident conditions.

- The method relied upon for oversight of the performance of the team during simulator training is to make this the responsibility of SOMs for their crews. While it is appropriate to expect SOMs to be responsible for providing feedback to their crews on areas for performance improvement in the simulator, they are not in a position to provide an independent assessment of either their performance or the overall performance of their crews (as they are intimately involved in participating in these exercises). During simulator sessions, the SOM is very busy with the procedure for independent verification of plant status. For evaluating the crew he relies on the comments of simulator instructors and on video tapes.

- The present system does not provide plant management with a way to review the relative strengths and weaknesses of each shift, to identify good practices in the simulator that might be adopted by other crews, or to ensure that required performance standards are being achieved. However, the Operations Department Manager does participate in feedback sessions held at the end of training courses. These feedback sessions are considered important and valuable by the participants, instructors, and the Operations Department Manager.

(1) Recommendation: Simulator training for the operations crews should be strengthened through the enhanced use of specific learning objectives and objective evaluation of performance.

Plant response (response given by: A. CHANTIOUX)

The learning objectives have now been formalised and effectively incorporated into the scenarios for situational simulator training. Based on the corporate training file, which only sets these objectives in a general way, the team of instructors has rewritten the scenarios and training guides mentioning clearly the learning objectives and performance expected. They have written training sheets filled in by the instructors which indicate for each sequence (simulator and debriefing):

– objectives aimed at,
– scenario chosen,
– break down of roles for the 2 instructors (co-ordination and observation of the topics),
– means used (video, grids, etc.),
– trainees' good practices to be repeated,
– practices requiring improvement,
– solutions proposed by the trainees to improve their practices. These will be evaluated during the following sequence,
– experience feedback on each sequence if necessary.

The application of these sheets effectively contributes to the achievement of the general training objectives of the situational training sessions. This facilitates the evaluation and traceability of new practices to be transferred to the field. This contributes to the standardisation and development of the training practices used by the instructors.

The training sheets have been approved by Bugey NPP and their application to training was audited by the plant training manager. The audit results show satisfactory practices when compared to the results expected by Bugey NPP.

IAEA comments :

Through discussions with Operations Department managers and SFP simulator instructors/supervisors and observation of a simulator training session, it was confirmed that the recommended improvements in the structure of this training have been effectively implemented. The training objectives are specific and the evaluation criteria consistent with these objectives. The difficulties observed during the training session were not related to the training objectives or evaluation criteria. One difficulty was that there was only one simulator instructor provided. It was clear that he was overloaded and was not able to effectively carry out all of his responsibilities. The other difficulty was that the team in the simulator training did not use the 3-way communication methods that have been identified as the Bugey standard for control room communications. Discussions with the simulator instructors indicated that it was not considered appropriate to enforce these communication standards during this type of training (on the new state-based EOPs). However, the experience of the Team is that the only way to achieve effective 3-way communication is to require its use for all simulator training and at all times in the control room. This is an example where management expectations have been identified in writing but where these expectations are not being realized because of insufficient day-to-day emphasis on achieving this management expectation. Again, this is a situation where the specific recommendation has been achieved. However, these comments are provided as an example of the Team's overall issue with insufficient emphasis on achieving management expectations.

Conclusion: Issue resolved.

(2) Recommendation: The plant should consider periodic non-shift line management observations of simulator training in order to evaluate each crew's performance and to maintain consistent standards among crews.

Plant response (response given by: A. CHANTIOUX)

After discussions between the operations department management and the plant training manager, a departmental document (D5116/NS/00002) concerning the practical methods for simulator training observation was written and will be validated during the first observation session planned in May 2000. This first observation session was planned for May 2000 as the training programmes have been modified since mid 1999 to take into account the changeover from event-based operating procedures to state-based operating procedures.

1. <u>Objective</u>:

There is a double objective to this observation: on the one hand, to ensure good training given by competent trainers and on the other hand to be able to judge individual and collective skills in fields clearly identified in situations on the simulator as a complement to what is an ongoing process (observation of professional practices) carried out by the shift team management and by the management of the operations off-shift structure. In addition, the observation of simulator training courses enables the management of the off-shift structure to observe the teams in non-routine operating situations (incident and accident operating conditions).

2. <u>Criteria chosen</u>:

The observation criteria chosen are based on the skills criteria of the operations department and on the corporate guidelines for abilities and knowledge for operations specialisations (craft areas). The only ones adopted were those fields of activity that can be observed and evaluated on the full-scope simulator.

3. <u>Use of the evaluation</u>:

Observation makes it possible to analyse, on the one hand, the team collectively and then each trainee individually in the function that he fulfills based on pre-defined criteria. An observation report is drawn up based on these criteria and indicates the areas for improvement. The objective is to propose to the trainee and the team to make improvements in the fields identified when the management detects any deviation from what is required.

IAEA comments

The observation sheets developed in response to this recommendation were reviewed. Also, a simulator training session was observed where these sheets were used. As a result, it was clear to the Team that Bugey implementation of this recommendation has been effective. Discussions also indicated that plant operators and supervisors had found this evaluation by Operations Department managers to be beneficial.

The Operations Department has committed in writing to a minimum of one observation of each shift per year, which is considered by the Team to be the minimum acceptable frequency.

Conclusion: Issue resolved.

2.3(2) Issue: Insufficient requirements exist to ensure control room operators and supervisors who do not perform their duties for extended time periods retain sufficient proficiency and are provided appropriate on-the-job training prior to resuming control room duties. There are no requirements for time away from these duties for less than six months. Practices used in other countries include proficiency watch-standing under the direction of authorized individuals if the period since the last shift exceeds several weeks. Without clear guidance on refresher requirements, operators and shift supervisors who are off shift for extended periods could be assigned duties for which they are insufficiently prepared.

Recommendation: Clear requirements should be established to ensure operations personnel who do not perform control room duties after a period of absence up to six months are provided appropriate retraining prior to resuming duties.

Plant response (response given by: A. CHANTIOUX)

Craft-specific requirements have now been defined in the memorandum document "administrative methods for the management of personnel from shift teams seconded to the methods branch of the operations department".

For control room operators and tagging supervisors

At the end of a secondment of between 1 month and 6 months, the control room operators and tagging supervisors spend their last day of off-shift secondment in the control room, in order to learn any changes adopted during their period of secondment: documentation changes, temporary operating procedures, modifications, incorporation of recent events, etc.

At the end of a secondment of more than six consecutive months, the control room operators and tagging supervisors attend refresher training on the simulator before assuming shift duties.

For operations technicians and field operators

At the end of a secondment of more than 1 month, the seconded personnel spend their last day of off-shift secondment carrying out field rounds and field operations activities with the morning and afternoon teams on shift to learn about any changes occurring during their period of secondment.

IAEA comments

Bugey has implemented all aspects of secondment addressed in this recommendation. This recommendation was addressed to control room Operators and Supervisors. In addition, in the response to this issue, the Plant has chosen to also address secondment of operations technicians and field operators. Discussions with Operations Department managers indicated that they had received positive feedback regarding the benefits of this requirement.

Conclusion: Issue resolved.

2.3(a) Good Practice: A multifunction simulator and the SIPACT (accident simulator) are used both to enhance operator skills (refresher training) and to develop skills and knowledge during initial training. Both the SIPACT simulator and the multifunction simulator are a complement to the full-scope simulator. Each tool has specific functions and is used in different contexts. While the SIPACT and the multifunction simulator use three work stations which do not reflect the same human machine interfaces as those in the control room and thus cannot completely replace the full scope simulator, they are an effective supplement to that training.

The multifunction simulator is mainly used in the training of operators as follows:

- For control room operators, it is used in the review of operating procedures and review of the theory on physical phenomena. In this application, the simulator is a visual support which helps to review operating strategies and the application of procedures.

- For field operators, training sessions are aimed at explaining and visualizing operating principles and their impact on field operators activities. (i.e. why an action is required in a given situation).

- For both groups, it is used for the review of the organization and application of operation sheets and for analysis of communications between field operators and control room operators.

In addition to the training sessions given by the operating training support team, the multifunction simulator is available for shift crews to use on their own for individual or team training.

The SIPACT simulator has been in operation since May 1997. To date, this tool has been reserved for use in initial training of control room operators and supervisors and for refresher training of shift crews. To use this simulator during initial training, trainees are expected to have the skills required for the accident operating module on the full-scope simulator and have knowledge of thermo-hydraulic principles for normal, incident and accident operation. This training tool contributes to the mastering of normal, abnormal and emergency situations. SIPACT enables trainees to acquire an accurate and thorough vision of physics and thermo-hydraulic phenomena and a mental model of the conditions in the reactor vessel, pressurizer, steam generators and connecting piping thus enabling them to have a better overall understanding of these processes during transient and accident conditions. SIPACT provides for both individual and team training on the following situations:

- Start up and shutdown of reactor coolant pumps.

- Control of primary pressure.

- Variation in boron concentration.

- One phase and two phase heat transfer and natural circulation.
- Control of steam generators during normal or abnormal operation.
- Steam generator tube ruptures.
- Secondary and primary circuit breaks.
- Safety injection sequences.
- ATWS.
- Total loss of feedwater supply to the steam generators.

SIPACT uses exactly the same thermo-hydraulic model as is used for the full scope simulator, while the multifunction simulator uses a more simplified model. Thus, for all situations SIPACT provides simulation consistent with the full scope simulator. The SIPACT presentations of thermo-hydraulic conditions have been integrated into the simulator instructor displays in the full scope simulator. During debriefing sessions of team training on the full scope simulator the SIPACT displays can be used to assist the shift team to understand the conditions during the scenario and how their actions affected these conditions. SIPACT provides a visual representation of thermo-hydraulics equivalent to that provided through a "glass model". However, SIPACT can represent a broader range of conditions and parameters than can be demonstrated through a glass model, as the reactor physics and radiation levels can also be presented.

2.4. FIELD OPERATORS

2.4(1) Issue : There is insufficient structure in the practical/on-the-job training (OJT) portions of the initial training programme for field operators (FOs).

The recently revised programme was viewed as a considerable improvement over the previous programme, which was largely unstructured. A review of the learning objectives for FO training revealed that there were specific, measurable objectives for the theoretical and classroom training portions of the programme. However, for the practical/OJT portions of the training, such learning objectives were not provided. For the integrated portion of the training programme, these objectives should relate to location and characteristics of plant equipment. For the on-shift portions, the learning objectives should relate to operation of equipment and systems.

The authorization process includes the use of a skills checklists that is used by the SOM. The use of this checklist is appropriate. However, it is not a substitute for structured practical/OJT as this checklist is written at a summary level of competencies and does not provide specific standards of expected performance.

The lack of specific, measurable learning objectives for practical/OJT training can result in not all FOs having the skills and knowledge needed for effective job performance.

Suggestion: The plant should consider upgrading the FO initial training programme to include specific, measurable learning objectives for practical training and shadow training.

Plant response (response given by: A. CHANTIOUX)

The memorandum document governing initial training for field operators (D5116/NS/96098) has been revised and has been at revision number 2 since November 1999. It now incorporates specific and measurable objectives for on-the-job training and shadow training.

A shadow training monitoring form has been produced. This shows the aim, the specific objectives of the training session, the activities carried out, the objective attainment measurement, names and signatures of those involved.

IAEA comments

Through a review of the revised memorandum document and examples of associated training materials, as well as discussions with a field operator trainee who has completed this training, it was confirmed that all aspects of this suggestion have been effectively implemented. The field operator indicated that during feedback sessions, he and his fellow trainees had indicated the benefit to them of having specific objectives as to what was expected of them during their practical training sessions in the plant. He also indicated that they had identified that even more benefit could be realized if one of the members of the shift team was tasked to help them to identify training opportunities on shift.

Conclusion: Issue resolved.

2.8. GENERAL EMPLOYEE TRAINING

2.8(1) Issue: Refresher training programmes may not be sufficient to maintain industrial safety and radiation protection performance of plant personnel and contractors at accepted international standards. While it is recognized that these performance weaknesses are not solely the result of lack of knowledge, there are some characteristics of refresher training that can allow knowledge deficiencies to exist.

A three year cycle is established for refresher training on radiation protection, industrial safety, quality assurance and nuclear safety, consistent with EDF standards which also identifies the minimum duration of these refresher training courses. An annual renewal is required for all authorizations; however, it is only under special circumstances, such as demonstrated inadequate performance or major changes in standards, that any retraining is required for this. It is recognized that there has been some additional training on a case basis. An example of recently implemented safety training was prevention plan training. It was focused on specific measures to identify potential safety hazards at work sites, and ways to avoid these hazards. This training was conducted as part of the preparations for the upcoming outage.

For many NPPs, there is an annual requirement or at most an every two year requirement for refresher training in these areas. Rather than specifying the required duration of such training, it has been found by some utilities to be more effective to specify the performance expectations and objectives for such training. Particularly with the greater use of individual instruction such as computer based training or distance learning the specification of a duration as the measure of the quality of training has very limited value.

Discussions with plant personnel indicated that the Maintenance Department has requested that all safety refresher training be integrated into one course that would be provided annually. This request was made, both to improve the quality/value of the training and to make scheduling and planning for such training easier.

Numerous examples of substandard radiation safety and industrial safety practices were observed by the team. More frequent refresher training, that focused on current issues and priorities would provide an opportunity for management to reinforce required/expected standards and for correcting performance weaknesses (the total time devoted for such training doesn't necessarily need to increase however).

Recommendation: The plant should review and strengthen refresher training programmes to ensure that industrial safety and radiation protection knowledge, skills and attitudes are maintained at high standards. Consideration should be given to reducing the interval between required refresher training courses.

Plant response (response given by: A. CHANTIOUX)

Refresher training in risk prevention/radiation protection

A study of the mechanism of refresher training was undertaken, resulting in:

- frequency reduced to 2 years,
- design of work site training facilities,
- revision of the training contents.

The new frequency of two years will lead to a better reactivity for incorporating operating experience feedback and changes in the requirements. This will contribute to improving knowledge for proper behaviour on a day to day basis. This frequency will be effective for training courses carried out in the second half of the year 2000.

The checks carried out in the field have highlighted improper knowledge of the practical actions of risk prevention associated with professional actions. The setting up of work site training facilities in the industrial environment (in the rooms of unit 1 currently being decommissioned) will help to fill in these gaps. This work site will be used for refresher training but also on request. Multi-specialisation work sites can be set up with incorporation of interfaces and also work sites specific to each specialisation. These work site training facilities will be operational as from May 2000.

A site wide working group was set up to study the contents of the refresher training courses. This study will consider remarks made during management industrial safety walkabouts, feedback on previous training courses and the availability of work site training facilities. This group will present its proposals to the Senior Management Team at the end of June. The new course contents will be effective for training as from the second half of the year 2000.

This revision of refresher training is a complement to the actions already carried out within the departments aiming to resolve inappropriate maintenance practices observed concerning the proper use of tools and handling (e.g. filters), etc.

IAEA comments

The planning completed to date in response to this recommendation has been well thought out and comprehensive. The use of a site wide working group to develop the approach to this issue was considered by the Team to be an important aspect. The construction of a work site training facility has been nearly completed which will provide for realistic practical training in radiation protection and industrial safety measures, as well as job-specific training for some job positions. However, considerable work remains to be done in implementing the plan. It is suggested that the site wide working group continue to remain in place until there is evidence that this training has been effectively implemented.

Conclusion: Satisfactory progress to date.

3. OPERATIONS

3.1. ORGANIZATION AND FUNCTIONS

The Operations Department of Bugey NPP is comprised of shift teams, together with the Methods Branch, which provide appropriate support to shift operation in training, preparation of operating procedures, monitoring of unit trends and parameters, preparation planning and scheduling of operating and outage activities.

Organization and responsibilities of the shift teams and for the members of Methods Branch are defined and understood. Procedures describe the responsibilities for each function. The department head delegates part of his responsibilities to qualified and authorized personnel within the Methods Branch.

There are seven shift teams for each twin unit. The teams are lead by the Shift Operations Managers (SOMs) who have responsibility for their team, including the planning and tracking of individual training programmes, evaluation of personal performance, and proof of fitness for duty. The SOMs are supported on shift by a shift supervisor and a tagging officer in order to fulfill all necessary duties. The teamwork is well organized and is considered of high importance for the crews.

The SOMs are responsible for the safe operation of their twin unit. They are granted appropriate authority and provided adequate support on back shifts. The necessary administrative tasks are performed by the SOMs, and therefore the shift supervisor is free to concentrate on technical issues.

The shift teams are adequately staffed, both during outages and normal operations. The appropriate number of personnel is clearly defined. The initial training of operations personnel is considered to be adequate.

During non-outage periods, staff are seconded for various coordinating, administrative or preparatory activities and the number of team members is sufficient. During outages, those seconded people return to their shift team. The plant requires that seconded personnel participate in all the training performed by their shift team, and additional simulator training is provided for those who have been off shift for more than six months. However, there are no written requirements for similar absences of less than six months. A recommendation regarding this is made in the Training and Qualification section of this report.

The department has a number of goals and objectives, both numeric and some stated as “as low as possible”. In the department, all personnel have annual appraisal meetings in which personal objectives are set, with the focus on nuclear safety and human performance.

In order to enhance the presence of managers at the work place, the Operations Department have institutionalized safety rounds that have to be performed. In the Management, Organization and

Administration section of the report, the team suggested that managers use these rounds to enforce their expectations and also to examine material conditions.

3.2. OPERATIONS FACILITIES AND OPERATORS AIDS

Each of the four units has a habitable control room with sufficient lightning. All necessary documents are available close at hand. The plant has installed a programme to create a serene atmosphere in the control rooms. Since the programme is fairly new, further enforcement will be needed in the future. The communication system is reliable, but the volume of the public address system loudspeakers in the control room seems disturbing. Several computerized systems are available to provide a comprehensive overview of the plant and to assist the operator. The number of unnecessary alarms was well under control, but a further decrease in the number of illuminated alarms could be beneficial. Regular checks are performed by the operators to retain an overview of the plant status.

Unauthorized and uncontrolled operator aids were observed throughout the plant. These can increase the risk for human errors and may therefore pose a threat to nuclear safety. The team recommended the elimination of unauthorized information in the plant and a programme for controlling and authorizing operator aids on site.

The general housekeeping in the plant is satisfactory. However, the cleanliness and the material condition of some specific pieces of equipment could still be improved. In recent years, the plant has put a lot of effort into the correct labelling of its equipment, but deficiencies in equipment labelling were observed. The team recommended to strengthen the programme for labelling in the plant in order to achieve a consistently high standard. Management expectations for the maintenance of labelling should be enforced.

3.3. OPERATING RULES AND PRECEDURES

New operational limits and conditions (OLCs) were introduced in January 1999. The structure of the new OLCs facilitates the use of the document. In addition to the 1.5 days of training given on the new OLCs, a leaflet on the application of this document was issued and is widely used. A thorough review and revision of the operating procedures was performed to assure compliance with the OLCs. Plant personnel are aware of the meaning and importance of OLCs. The events and operating situations affecting OLCs were observed to be the most significant topics at operations meetings and priority was given for work requests on safety related equipment.

A separate logbook has been implemented to document entries and exits of OLCs. The use of this logbook was considered to be acceptable. A white board to display recent conditions which should reflect the same information as in the logbook is installed in the control room. The consistency of entries in the logbook and the white board was observed to be adequate.

The responsibility for review and approval of operating and test procedures has been delegated by the department manager to qualified and authorized engineers within the operations department. The operations personnel are deeply involved in the preparation, modification and the development of procedures. Their proposals and remarks are incorporated before approval of the procedures. A significant number of procedure modifications is initiated by shift personnel.

Alarm, emergency, beyond design emergency and ultimate intervention procedures exist and are in use. During observations, personnel demonstrated proficiency in the use of alarm procedures. The implementation of sensitive transient sheets to support pre-job briefings for planned transients was considered by the team as a good practice. Symptom based emergency procedures are in development and will be introduced in 2000. Training has already commenced for the introduction of this new type of procedure.

Incident and accident related procedures are regularly reviewed. However, normal operating procedures are not regularly reviewed. There are no requirements to review the normal operating procedures and several deficiencies, such as ; provisional procedures that had been issued a long time ago, expired temporary instructions that had not been removed from the procedure and procedures overdue for revision were observed.

The team suggested that the plant consider establishing clear requirements for the control and periodic review of operating procedures and monitoring the performance in this area.

3.4. OPERATING HISTORY

Operating history is kept by means of log keeping per function and by computerized rounds performed by the field operators. These computerized rounds differ between shifts, from winter to summer and between normal operation and outage. Programming is to ensure that every room is visited at least once per day. Logging of the transient history is performed by the Methods Branch. The results of periodic tests on diesel generators, the auxiliary feedwater system and the safety injection system are entered into a computer system. However the results of available data has not been used to improve reliability.

The criteria to report significant events and specified non-significant events are well known. However, there are no criteria to report events that are not covered by these lists. The effects of certain events on the plant operation are evaluated by two engineers of the Methods Branch and reported in a weekly operating report. The document is widely distributed in the plant including the operations shift crews. The information is also stored in a very accessible database for further use on experience feedback by SOMs during their shift and to all other staff members on site. It also serves to make people more attentive to the programme to reduce the volume and radioactivity of released liquid effluents.

Although training in root cause analysis has been given, there is no systematic use of the methodology for non-significant events. The use of clear criteria for non-significant event reporting and the use of root cause analysis for these events would support the improvement of human performance and the prevention of repeated events within the Operations Department.

For the training on operations feedback the department organizes one or two days of classroom training per year. For events that are not covered in this training, the department relies partially on the judgment of each shift manager to brief his team on events described in the weekly operating report. Consistency between different teams is not guaranteed.

The operating history is not always stored in fire proof rooms or cupboards. A small fire could lead to the loss of important information.

There is no standardized method to report data in periodic test procedures. This makes it difficult to reconstruct or analyze test results.

3.5. CONDUCT OF OPERATIONS

The control room, in general, gives the impression of professionalism. Although no technological means to limit control room access has been implemented, the number of people in the control room was acceptable.

The observations of simulator training exercises revealed that further improvement is possible in the communication between control room personnel in repeat back and in three-way communication.

Operating procedures are of good quality, available in the control room and are used. However the marking of step by step procedures differs from shift to shift. More detailed expectations may improve the performance of the personnel in this area. Deficiencies in the use of control room operator checklists were observed. The team recommended the plant implement clear requirements on application of checklists and strengthen the supervisory oversight of the use and review of the recorded data.

Restarts following reactor trip or outages are formalized and supervised by appropriate management level.

Shift turnovers of the shift supervisory personnel were observed to be very detailed, professional and high quality. The briefings following the turnovers are adequate to assure the information exchange within shift crew. During debriefing and shift turnovers, the unavailability of safety related equipment is given the appropriate priority. The observed rapid shift turnover and the practice of performing surveillance tests in the control room during turnovers may however cause degradation in the overall effectiveness of shift turnovers.

Safety could be enhanced by increasing the number of periodic reviews of the administrative and safety tags in the field and also by developing a system to prevent line up errors. Therefore the team recommended that the plant enhance the conduct of system line ups, the use of independent verification and periodic review in the field. In addition, the plant should establish clear criteria for reporting events on status control deviations in order to maximize the learning opportunities from these events.

Field operator rounds are supported by special portable computers which are good tools to record, compare and submit important plant parameters. However the observed rounds were extremely focused on the parameters required by the computer and were not satisfactorily attentive to material condition, industrial safety and fire protection deficiencies. The team recommended that the plant improve the effectiveness of field operator rounds.

3.6. WORK AUTHORIZATIONS

Procedures for work control, testing and equipment restoration are used. The process is fully computerized including approvals for the removal of equipment from service and printing of tagout sheets.

The shift manager is responsible for granting permission for isolation of equipment. Before permission is given, a risk analysis is performed to evaluate compliance with OLCs and to define challenges to safety, radiation and industrial safety hazards and to define necessary compensatory actions to be taken. Special general risk analysis is performed before plant outages.

The key points of the equipment isolation are specially marked to facilitate independent verification of safety. Independent verification is occasional and limited to several systems.

Documents of recent maintenance activities are stored in the tagging office and classified per system. The control room personnel have information on ongoing work and are specially notified when work involving a fire hazard is started.

Temporary modifications are approved by the shift managers, and recorded in the plant work computer system. Some temporary modifications have been in existence for a long time and the plant has no expectations for periodic review of temporary modifications. In several cases it was observed that the operators added technical information to the temporary modifications tags in the control room. The team considered that additional information on temporary modification labels in the control room may be useful in enabling operators to gain a rapid understanding of the content and reason for the existence of the temporary modification.

3.7. FIRE PROTECTION PROGRAMME

Bugey NPP is performing an upgrading of the fire protection systems. This programme will continue through 1999 and 2000.

According to the EDF policy, the installation is divided into fire sections and fire zones. The follow up of the fire sections is very strict and well organized.

There is no policy to prevent smoking in operational areas of the plant. Cigarette ends were present in areas where fire hazards exist such as; diesel generator rooms, near the main generator, near the lubrication oil tank and in cable rooms. Smoking in areas with highly combustible material can jeopardize nuclear safety at the plant.

In the area surrounding the reactor building of Unit 5 a large amount of wood is stored for the construction of scaffolding. No fire detection or fire protection is installed in this area.

Throughout the plant, numerous plastic fire action sheets are mounted near the entrances of the fire zones and also near the locally mounted information and operating panels of the fire detection and confining system. The system is very informative and helps field operators in rapidly taking the necessary actions to warn the control room and to confine the fire zone. Close to the action sheets, there is always a telephone and fire fighting equipment available. For the operators in the control room, easy to use action sheets are present.

Responsibilities for fire fighting are well known and understood. Training is adequate and occasional drills with the public fire fighting services is organized.

For the control of fire load, the plant is dependent on the people that organize the work. The presence of burnable material can last for a long period of time (example wooden cable drums in electrical rooms). After completion of work, some burnable material is not removed (for example security bandages on cable trays, and oil dripping bag in the neighbourhood of a pump in the turbine hall of unit 2).

During repair activities, the maintenance supervisors calculate the fire load induced by their work places. A global overview on the fire risk in the plant due to maintenance activities is not available to inform the fire fighters of the operations crews.

3.8. ACCIDENT MANAGEMENT

Roles and responsibilities during emergencies are clearly defined within the Operations Department. The shift composition for immediate actions is defined by OLCs. The availability and response of support organisations is as required by corporate standards. A technical support center is established for on call personnel to perform the evaluation of the event, and provide appropriate assistance both to the control room and the site emergency center. Technical information is adequate to analyse events and the appropriate means is provided for communication. The availability of the technical support center may be further enhanced if provided with individual protective equipment such as respirators and coveralls, etc.

Drills for operations shifts are periodically performed, including the use of equipment for ultimate intervention.

STATUS AT OSART FOLLOW-UP VISIT

In general, good progress has been made toward resolving the operations issues. Of the five recommendations, one was found to be resolved and four were found to have satisfactory progress. The one suggestion was found to have been resolved.

A structured, systematic approach was taken with respect to each issue, including appropriate involvement of personnel at all levels in the Operations Department. The actions taken with respect to these issues indicated that there was good understanding by the plant of the issues. These actions also indicated that the Plant had taken ownership of the issues, and realized the potential benefits to be gained through implementing effective solutions for these issues.

The issue for which there is the most work to be done in order to achieve a lasting solution is plant labelling. Considerable work remains to be done to replace or improve the labels. In addition, there is no method yet in place to deal with the root cause(s) of the deteriorated or missing labels. Without this, the considerable efforts taken to upgrade the plant labels will be undermined. Another, related issue that has been planned, but not yet implemented is improvement in field operator rounds to identify abnormal plant conditions and deficiencies.

The Team's principal concern is that enthusiasm for reporting deficiencies soon wanes if these deficiencies aren't corrected in a timely manner, or if the improvements in housekeeping and labelling are undone through subsequent activities.

DETAILED OPERATIONS FINDINGS

3.2. OPERATIONS FACILITIES AND OPERATOR AIDS

3.2(1) Issue: Many operator aids were found in the plant that were not authorized or controlled. Contributing to this, the plant does not have written guidance to authorize and control operator aids in the plant.

Examples of uncontrolled operator aids were as follows:

- Plant instruments were marked with felt-tip pen to indicate operational limits.
- Indicators on the switchboard of TEU and TEP systems.
- Normal pressure/temperature readings marked on CVI-01RG panel in the unit 4 turbine building.
- On 5LTA001ID in the main control room of unit 5.
- On 5RCV003ID in the main control room of unit 5.

Examples of uncontrolled posted instructions and information were as follows:

- An instruction to rearm the overspeed protection of the turbine driven feedwater pump in room W020 (auxiliary building unit 4/5). The instruction is not signed and has no version number .
- Instructions written on paper stickers on the switchboard of TEU and TEP systems.
- Two values are written on stickers indicating values in cubic metres under each of the level indicators 9TEU008ID and 9TEU001ID that indicate in percent. The same switchboard also has extracts of procedures which are mounted with tape.
- Procedure pages are posted on the wall in unit two and three hydrogen seal oil system rooms.
- An old temporary notice is posted on the wall next to the entrance of the unit 5 hydrogen seal oil system room.
- Valve numbers are written on the wall or on insulation with felt-tip pens in many rooms.

– A temporary operator aid is attached to remind the operator how to read the scale of the hydrogen leakage rate meter on the degasser tank in unit 5.

– Operating instructions are written in felt-pen on the body of the sandfilters associated with CW-pumps in the cooling tower pump house.

– A handwritten instruction that states to always keep the valve closed is posted on 5SAP101VD.

– A procedure for filling the reservoir is posted on 4JPD012BA.

– Setpoints are posted with dymo stickers on recorder 5KSC413EN in the main control room of unit 5.

Uncontrolled posted information was also seen in other areas of the station such as chemistry laboratories, in the fuel handing building and near the exits of the controlled area.

Unauthorized and uncontrolled operator aids increases the risk for human errors and can lead to improper safety system operations due to inappropriate instructions and information.

Recommendation: The station should identify and eliminate all unauthorized information in the plant. In addition, the station should properly authorize and control all operator aids on site.

Plant response (response given by: S. BLOND and C. GUETAT)

After analysis of all the recommendations and suggestions, the operations department drew up an action plan which was distributed on 26th May 1999. A working group was then set up to propose solutions to the department manager. This group, composed of a member of field staff from each team, met 4 times (21 June, 12 July, 7 September and 30 September 1999). Between the meetings, the representative of each shift team worked with his team to gather the various ideas and suggestions to enable him to contribute meaningfully to the plenary meetings. The conclusions were then presented to the operations department manager on 19th October 1999.

In the area of information displayed, the following actions were taken:

- The places where information in the field are necessary were defined. Concerning the displaying of information in the control room, a shift team is in charge of checking and ensuring that the information is necessary and adheres to QA rules (teams G and C'). For the industrial premises, the list of places for displaying information is presented in the appendix of the departmental document (D5116/NS/00001 written and approved 07/03/2000). Any signs not appearing on this list are to be removed.

– All requests for labels are addressed to the logistic support team of the methods branch of the operations department.

– Regarding information management support and methods (placing, periodic checking, formalism, etc.), it was decided that all the special signs will be in the form of self-adhesive labels written and managed by the logistic support team of the operations department which is equipped with a printing machine. Various tests have been carried out to choose the type of support which best suits hot atmospheres, with the presence of oil, water, etc. Mechanical drawings are available in Plexiglas boxes with BUE/SCO references and managed in accordance with document D5116/NT/95132 "geographical location of mechanical drawings for units 0-2-3-4-5 and 9".

– Any unofficial signs are removed during field tours and plant inspections. The team in charge of housekeeping is to be informed of any graffiti or inscriptions in felt tip pen and will remove these.

IAEA comments

During tours of the Plant by Team Members, almost no unauthorized operator aids were found. The only exceptions were with respect to a recently completed maintenance activity and a handwritten schematic on a panel in a room that has not yet been inspected/reviewed by the Housekeeping Team. However, there is still considerable work to be done in this area, as the Housekeeping Team has only completed its review of approximately 15% of the plant rooms. Also, continued diligence will be needed in order to enforce the written management expectations regarding the control of operator aids.

Conclusion: Satisfactory progress to date.

3.2(2) Issue: Deficiencies exist in plant labelling that include incomplete, unapproved and deteriorated labelling. Although procedures were implemented to define responsibilities and requirements to maintain good condition of plant labelling, many deficiencies in labelling were noticed during plant tours.

Examples of the types of deficiencies that were observed are as follows:

- Numerous valves were missing labels and some had broken labels with part of the information missing.
- Some pressure gauges and other instruments were missing labels.
- Some labels were handwritten on the component or on tape that was applied to the component. In some cases this information was incomplete or illegible.
- Some labels , signs and location identifications had been painted over.

The station expects all equipment to be labelled. However, some major equipment such as turbine control valves and cooling tower pumps were not labelled.

It was observed that during field operator rounds and while tagging equipment personnel do not record labelling deficiencies. There are special rounds performed to identify labelling deterioration. However, they have not been sufficiently, effective in correcting the existing problems.

The plant reported that they replace up to 4 000 damaged or missing labels per year and attributed many of the label problems to poor work practices.

Inconsistent and poor labelling in the plant could lead to human errors, personnel injury and incorrect system operation and isolations.

Recommendation: The plant labelling programme should be strengthened to achieve an appropriate standard of labelling. Management expectations for the maintenance of labelling during and after plant activities should be reinforced.

Plant response (response given by: S. BLOND and C. GUETAT)

After the working group's conclusions (cf. heading recommendation 3.2 (1)).

In the area of labelling, the following actions were taken:

- The rules for placing the labels according to their position were defined. The support materials, rivets and glue had already been defined (stores articles). Furthermore, it was decided to place aluminium labels on all the points where the temperature is >50°C, as the Gravoply label breaks up, falls or melts. For points <50°C, the label will be made with an adhesive. In the reactor building, the Gravoply labels are still used.

– An organisation to upgrade the labelling (in-depth examination of the rooms, field observation sheets, etc.) was defined by the working group on "housekeeping". The discrepancies observed during field inspections were noted on sheets and then entered into the Lotus Notes database by the logistic support team of the operations department. As at the 8th March, 715 files on the rooms are ready for units 4/5 with 108 inspections completed. For units 2/3, 831 files are ready with 100 inspections completed. The inspections are entrusted to seconded field operators. The co-ordinator of the power operations structure is in charge of resolving the discrepancies and of following up on the commitments made by the departments. For units 4/5, 100 files remain to be compiled. The labelling itself is upgraded by the members of the operations department taken off-shift, 2380 labels have been placed on units 2 to 5 since 15th November 1999.

– An organisation to remove the unneeded label holders was defined: these are mentioned in the discrepancy report which is filled in after each field inspection. These are then removed by the housekeeping team. This team has been operational from the beginning of April 2000.

– It has been decided to no longer use the stencil (except for particular cases) to identify large items of equipment but to use self-adhesive labelling.

IAEA comments

A comprehensive approach has been developed to restoring the damaged/missing labels in all areas of the plant that are the responsibility of the Operations Department. However, to date, re-labelling has been completed in only about 15 percent of these rooms (the documentation as to the required labels has been developed for all rooms). A review of the labels in a sample of those rooms indicated that this re-labelling has been effective. There are, however, some unresolved issues with respect to this implementation. One is that while a verbal commitment was indicated to complete this effort by the Summer of 2001, this commitment is not reflected in strategic plans, and also there are no intermediate goals regarding progress in this area, or tracking of progress with respect to these goals. Although discussions have been held on methods to prevent labels from being removed or damaged in the future, no method has not yet been implemented.

Conclusion: Satisfactory progress to date.

3.3. OPERATING RULES AND PROCEDURES

3.3(1) Issue: Some important station procedures are not periodically reviewed and replaced with timely revisions when needed. Incident and accident related procedures are required to be reviewed every two years. The regular review of normal operating and alarm procedures is not required. Examples of procedures that have not been reviewed for extended time include the procedure for pressurizer relieve tank unit 2 coded CO/F RCP-1 was revised in 1989, procedure CO/S 0-9 LNE was revised in 1992, F-RCV3 unit 2 was revised in 1991, F-RCV4 unit 2 was revised in 1989 and procedure GP4 unit 5 was revised in 1990. Industry practice is to perform periodic reviews of important operating procedures.

Some of the procedures were revised with handwritten changes and issued as "provisional for validation" and have remained in that state for a long time. Examples of this are the procedures for common system (9) of unit 4 and 5 coded CO/S JPD for ultimate fire fighting pump and the procedure 3 CO/F RPN 1 both of which had been issued for validation in 1995.

Expired changes of the procedures are sometimes not removed promptly from the procedures. Temporary procedure 301 issued on 25/07/97 was found attached to procedure CO/S PTR on unit 2 although this temporary procedure was deleted from list of valid procedures in September 1997 and the affected procedure was revised in 1998.

A programme of periodic review of procedures and timely revisions can help to reduce errors in personnel activities and actions.

Suggestion: The station should consider establishing clear requirements for the control and periodic review of important operating procedures and conducting periodic reviews of performance in this area.

Plant response (response given by: S. BLOND and C. GUETAT)

The Operations Department decided to review all operations procedures that have been in place for more than five years. This process is currently taking place. The organisation memorandum entitled 'Operations documents' (ref.: D5116/NO/92003) has been modified as such.

Out of all the operations procedures, both safety-related and non-safety related (895 in total), there are still 51 procedures remaining whose validity date will date back to more than 5 years by the 30th June 2000. Of these 51 procedures:

- 14 are currently being updated and will have their revisions completed within two months;
- 9 apply to ten-year outages and will be revised just before these outages;

- 3 (non-safety related) are waiting for the KZR system to be put in to service on unit 5;
- 4 (safety-related) are waiting for completion of analysis by the Engineering Department;
- 2 (safety-related) should be reviewed shortly;
- Therefore, there are 19 remaining to be dealt with (of which 8 are safety-related) that will be reviewed by summer 2000.

IAEA comments

The changes made in the Plant's periodic document review system addressed all aspects of this issue identified by the OSART Team. The overwhelming percentage of procedures has been reviewed in accordance with this system. The few procedures remaining to be reviewed have been identified within the system and a schedule developed for their review. Discussions with cognizant personnel indicated that about 80 % of the procedure changes were identified by operators through their use of the procedures and only 20% through periodic review. The information is available without much effort as procedure changes are initiated and tracked through work requests. Thus, the Team felt that this ratio could be an effective tool for Bugey Operations Department managers to use as an indicator of the effectiveness of the procedure revision system. (The higher the ratio of operator identified changes to periodic review changes, the better).

Conclusion: This issue is resolved.

3.5. CONDUCT OF OPERATIONS

3.5(1) Issue: Control room operator checklist sometimes contain incomplete, inaccurately recorded or out of specification data that is not corrected by supervisors. These checklists are used to record important plant parameters.

The following examples are observed deficiencies with the checklist used by each shift to monitor and record system parameters:

- The level of the safety injection tank was recorded as below the allowed limit, but marked as acceptable.
- In an another case, the difference between two level measurements of the safety injection tank was recorded as outside the acceptable range, but marked as appropriate.
- The shift supervisory overview of the records did not correct any of the failures.

In the observed periodic test of diesel generator on unit 5, the following deficiencies were observed:

- Some operators recorded the status of equipment prior to the test instead of after electrical equipment was disconnected from the grid as stated.
- Some operators recorded status checks as yes or no and others only entered a mark to indicate it was checked.

There are no written requirements on proper use of the checklists.

Values were also sometimes corrected using correction fluid. The use of correction fluid is prohibited.

Errors in monitoring , recording and review of important system parameters can result in degradation of safety.

Recommendation: The plant should implement clear requirements on application of checklists and strengthen the supervisory oversight of use and review of the recorded data.

Plant response (response given by: S. BLOND and C. GUETAT)

Clear expectations have been defined and displayed by the operations department concerning the filling in and checking of the various documents (logs, surveillance tests).

- The requirements for filling in the operators' log during power operations were defined and have been displayed on the logs themselves (at the bottom of the page) since autumn 1999. This was done for the control room logs for outage periods at the beginning of the year 2000. These will be used for the outages in the year 2000.
- The requirements for filling in surveillance tests procedures (EP) were defined and the document D5116/NS/99016 "requirements for carrying out surveillance tests in the operations department" was written and distributed to all the shift teams on 22/11/1999.
- Improving the quality of checking: all the checks to be carried out by the shift teams, the methods branch and the management of the operations department have been defined. These checks are formalised in document D5116/NS/95006 "methods for carrying out checks in the operations department" which was distributed to all the shift teams and the managers in the methods branch on 23rd February 2000.
- At the same time, since May 1999, the department has implemented checking of surveillance tests carried out during power operations in weeks 20, 31 and 48. The aim of this checking is to ensure that the completion of the surveillance test corresponds to the scheduling, the procedures are filled in according to our requirements and the work requests issued after the surveillance test have been dealt with.
- In August 1999, checking of all the sensitive transients involved the documents filled in and modifications of the support sheets for these transients. All the documents were updated in December 1999 to take into account the discrepancies observed.
- For the year 2000, it is planned to examine surveillance tests every six weeks. The first check showed only one discrepancy for the 165 surveillance tests carried out in week 2. This improvement is as a result of the actions initiated in 1999. The other checking operations involve:
- surveillance tests during all the outages,
- sensitive transients,
- examination of the shift turnover logs (field staff, control room operators - tagging supervisors - shift supervisors - shift managers),
- temporary operating procedures,
- temporary installations (DMP) (this check will be carried out together with the engineering department).

All of these checks are monitored and tracked by the methods branch of the operations department.

Improving the management of temporary operating procedures: to achieve this, the relevant document D5116/NS/93059 was modified and distributed to all the shift teams. The modification involves the use of a stamp filled in for the prolongation of the validity of the temporary operating procedure and photocopies on coloured paper of the documents concerned to facilitate the identification in the procedures.

IAEA comments

All areas of the recommendation have been addressed. The establishment of a job position dedicated to the review of completed surveillance tests, checklists, logs and other operational data has resulted in greater attention to the quality of operational data reviews by all shifts. This improved quality is indicated through the significant reductions observed in the frequency of inadequate operational data. It is suggested that the Plant use the information collected on the quality of operational data as a performance indicator and that goals be established as to the quality of this operational data.

Conclusion: This issue is resolved.

3.5(2) Issue: Field operator rounds are not sufficiently effective to identify abnormal plant condition and deficiencies.

During observations of some operator rounds in the turbine hall and the nuclear auxiliary building the rounds were performed very quickly. In many cases, operating equipment was past without being checked for abnormalities.

The operator rounds were observed to follow a route which is defined by the special computer that is used by operators to record required conditions and parameters. The use of the computer does facilitate recording of monitored parameters. However, the observed operators focused on obtaining the computerized data and followed the route needed to collect the data quickly without sufficient attention to plant deficiencies that existed.

During these rounds, several material deficiencies were not recorded, papers on the floor were passed without removing them and puddles on the floor were passed without taking any corrective action.

It was also observed that safety fencing barriers were applied to working areas for maintenance or plant cleaning in a manner that limited the proper operator activities. In many cases, the barriers enclosed wide areas and did not include any information on the work which was supposed to be in progress. The operators did not initiate action to correct these improper barriers that restricted their access.

Ineffective operator rounds impact the timely identification of equipment and system deficiencies and can lead to degraded safety.

Recommendation: The station should implement methods to improve the effectiveness of operator rounds and reinforcement of expectations.

Plant response (response given by: S. BLOND and C. GUETAT)

To strengthen the quality of the field operator rounds, the working group issued conclusions which led to the basic rules (requirements) of the field operator rounds being displayed and to the remodelling of parameter readout activities to ensure better plant monitoring.

At the end of June 1999, following the work carried out by 2 seconded technicians and the methods branch manager responsible for computerised field operator rounds, it was decided to set up theme-based and observation field operator rounds as a complement to the parameter read out activities. From September 1999 to February 2000, within the framework of a new off-shift secondment, these 2 employees drew up field operator observation rounds and proposed the contents of the theme-based field operator rounds.

Since October 1999, the alarm thresholds and the associated tolerances (monitoring of the changes between two consecutive read outs) have been in place for the monitoring of the following points:

- read outs of water and gas consumption meters,
- pressure drop in the water circuit filters,
- oil tank levels.

As of the 3rd March 2000:

- Theme-based field operator rounds (covering a pair of units):
- 18 theme-based field operator rounds have been written,
- 6 theme-based field operator round still remain to be written; they concern equipment within the nuclear auxiliary building.
- Observation rounds (covering a pair of units):
- practical guidelines for carrying out observation rounds on the diesel rooms, air compressors, unit 2/3 pumping station, turbine building, electrical building and external facilities have been written,
- practical guidelines for carrying out observation rounds in the nuclear auxiliary building still remain to be written 6.

The target for implementing the theme-based rounds and observation rounds is set for the end of the year 2000.

The NPP housekeeping standards are incorporated into the observation round through the following permanent surveillance points:

- general housekeeping of the room or area inspected,
- leak management (identification, marking, collection, etc).

These arrangements will be formalised in the departmental memorandum "methods for carrying out field operator rounds within the operations department" which is currently being written.

The deviations that the operations staff have to resolve themselves in real time during the field operator rounds are marked with the identification "A" for the observation rounds.

So as to improve management control of field operator round through checking, the departmental memorandum "methods for carrying out round in the operations department" defines the tasks of each person for checking:

- 1st level (self-checking) by the person in charge of carrying out the round,
- 2nd level (supervisory check) by the control room operator,
- external checking by the methods branch.

Eventually, checking of field operator activities will be incorporated into the memorandum (D5116/NS/95006) "methods for performing checks within the operations department".

IAEA comments

A comprehensive system has been developed to improve the effectiveness of field operator rounds based upon inputs and suggestions from field operators. Considerable effort has been devoted to developing a training programme to facilitate the effective implementation of these new field operator rounds. Discussions with Operations Department managers indicated that they have also revised the action thresholds on checklists and annunciators to initiate earlier actions in response to abnormal conditions. The Team encourages management to closely follow the results from these new rounds in order to promptly identify any needed revisions to the system.

Conclusion: Satisfactory progress to date.

3.5(3) Issue : Operations activities to change status of plant systems or to maintain plant status control are not always effective and have resulted in station events. In addition, reports are not always written to record and subsequently analyze these status control events which are possible precursors to more serious events. In some cases, the lack of independent component positioning verification has contributed to the errors.

The following are examples of improper positioning of system components:

– During the OSART mission, prior to the planned shutdown of Unit 3, the make up water system was found to have a high oxygen concentration and radioactivity level. Initial conclusions were that one valve (0 TEP 052 VP) had been tagged for operational purposes in the open position instead of the closed position. Another valve had also been positioned in open position instead of the closed position.

– Valve 2 RRI 008 VN required to be locked for maintenance activities on a component cooling water heat exchanger was found unlocked. No subsequent event report was written about the discovery of this anomaly.

– During the preparation for a hydraulic test on heat exchanger 9 TEP 004 RE, the maintenance work team identified that the vent line between the two isolation valves was tagged open but the end cap was still in place and therefore the vent was not open to the atmosphere.

– In June 1998, a significant event was reported regarding high sodium content in a steam generator. One of the root causes for this event was a line up error or a valve not completely closed.

– In January 1998, a significant event was reported on improper removal of the tagging on the containment spray cooling system.

– Examples of valves found locked without tags were: 4 ANG 31 VL, 4 ANG 32 VL, 4 ANG 33 VL and 4 GGR 159 VH.

– In some cases, subsequent event reports were not written.

During operations of the plant, the line up of safety related systems is guaranteed by means of administrative tags with specific labels and locks. Shift managers perform an administrative weekly check based on the absence of corresponding labels in the tagging office. Reviews in the field are also performed by spot checks initiated by the shift managers. A systematic review in the field is not performed.

Long outstanding tagouts are checked administratively by the tagging supervisor. There is no periodic review of the tagouts performed physically in the field.

Inappropriate system line ups and control of system status can lead to the unavailability of safety related equipment, personal injury of workers, and the unnecessary production of radiological waste.

Recommendation: Management should place additional emphasis on enhancing the conduct of system line ups, including the use of independent verification and periodic surveillance in the field. In addition, the plant should establish clear criteria for the initiating of event reports for status control deviations.

Plant response (response given by: S. BLOND and C. GUETAT)

The operations department has identified three areas for the improvement of line-up quality:

– Training of the participants

All the shift teams attended training in line-up operating experience feedback for one day in Autumn 1999. This training consisted of the presentation of the various events calling into question line-ups, making the participants aware of the accuracy required in this activity and explanation of the memorandum (D5116/NS/99004) "organisation of the operations department for carrying out and checking system line-ups". This training was also the opportunity to discuss with the shift teams about the notions of checking and trust.

– Writing and updating of line-up and checking procedures

This activity has been entrusted to control room operators taken out of the shift teams. The progress as at 1st March 2000 is as follows:

Line-up procedures:

- 1512 line-up procedures for systems ABP to VVP, have been written, checked and entered in the computer application (AIC).

- Procedures for checking line-ups:
- 193 procedures for checking line-ups for systems ABP to CVI, have been written, checked and entered in the computer application (AIC),
- 188 procedures for checking line-ups for systems DCC to LHH, have been written, checked and entered in the computer application (AIC),
- about 200 procedures for checking line-ups for systems LLS to VVP, are still to be written.

- The standardisation of the practices of control room operators seconded to the various outages for co-ordinating line-ups

The various control room operators who fulfilled the role of line-up co-ordinator for the outages in 1998 and 1999 met to discuss about their respective practices. They defined the common requirements and methods which were then formalised in a rapid information document distributed before the outage of unit 3 pending incorporation into memorandum D5116/NS/99004 mentioned above.

In addition, action has been taken to ensure that line-up activities are clearly marked in the outage schedule for the year 2000. Consideration has also been given to having the control room operator seconded to co-ordinate the line-up assisted by a field operator by the year 2001.

IAEA comments

A comprehensive approach to addressing this issue has been developed, and most aspects of the approach have been implemented. There are, however, still a significant number of lineup checking procedures to be written. The plant is now tracking low level system lineup incidents and analyzing the lessons learned from these incidents in order to make further improvements in the system. Preliminary indications are that the frequency of significant valve lineup errors is decreasing. The Team encourages the Plant to continue to track minor valve lineup errors and identify their root causes as a tool for avoiding more significant errors, and in continually improving the valve lineup and checking system.

Conclusion: Satisfactory progress to date.

3.5. CONDUCT OF OPERATIONS

3.5(a) Good practice: The operations department has implemented a structured approach to deal with planned sensitive transients.

A cross functional work group with people from shift operations, operations support and the Safety Quality Team identified the transients that might require a specific preparation and follow up by the operators. The identified transients were as follows:

- Load variation;
- Going from hot shutdown to intermediate shutdown on RHR;
- Collapsing the pressurizer bubble;
- Insertion of control rods before going to cold shutdown for maintenance;
- Going to “RCS open” or “RCS partially open” cold shutdown for maintenance;
- Operating with the RCS depressurized;
- Going into mid-loop operations;
- Emptying and filling the reactor vessel pool;
- Core unloading and reloading;
- Starting-up the first RCS pump;
- Taking the reactor critical;
- Manual control of SG’s under low load conditions;
- Full load reject test.

The 13 identified transients were thoroughly analyzed in view of their relevance to safety. A special sheet was prepared to assist the shift manager and the shift supervisor in performing a thorough pre-job briefing with key points that could affect nuclear safety. These sheets are used each time prior to the sensitive transient. Time is allocated in the planning of shutdown and restart of the plant to allow for utilization of this approach.

All control room operators were provided training in this method in 1997. Field operators were also trained in some specific transients.

To complement and enhance this approach, the Operations Department defined and implemented training in this area for the operators in 1998. The Operations Department has also required that the sheets be used during simulator training since 1998.

4. MAINTENANCE

4.1. ORGANIZATION AND FUNCTIONS

Heavy maintenance activities are assigned to the Maintenance Division and light maintenance activities to the Production Division. This structure is supported by cross-function units such as the Technical Advisory Unit, Safety Quality Advisory Unit and Bugey Service and Contractor Relations. Heavy maintenance units in the Maintenance Division such as the Rotating Machines Department and the Valves and Boilermaking Department, serve all four units and also provide support to the light maintenance departments within the Production Division. The light maintenance units are the Electrical and Instrument and Control (I&C) Departments.

Ownership of all equipment has been assigned and the boundaries between departments defined. Work specification is conducted by the assigned owner, however work can be carried out by another plant department or contractor.

Information regarding the plant maintenance policy has been communicated to all maintenance personnel. The policy includes statements on safety aspects, optimization of availability, the increased use of reliability centered maintenance and plant life expectation. Maintenance management expectations are further communicated by the use of safety posters in the plant.

Performance contracts which define objectives are agreed on a yearly basis. The team encourage Bugey to establish objectives over a longer time period and also to include in their assessment objectives and indicators for rework.

Interfaces between Operations and Maintenance Departments are controlled by the "Unit-in-operation" co-ordinator during operation and the Outage Project Manager for a unit in outage. Meetings are held for co-ordination and information transfer depending on the status of the plant. This was considered to be effective. A systematic approach for the management of equipment unavailability was noted by the team to be a good tool for maintaining compliance with the technical specifications. The outage management was well organized and supported, with excellent facilities and equipment for planning.

The EDF and Bugey NPP policy in relation to contractors focuses on ownership and sharing work between EDF and the service providers. A "Charte" has been signed by EDF and the services provider associations to develop relationships on long term basis, guarantee skills and experience comparable to plant personnel and enhance the quality of performed work. A contractor evaluation process has been developed that includes audits and evaluation of performed work, and also control of individual contractor qualifications. However, the team observed work practices in the plant that were not complying with the intention of the "Charte" and the team encourages EDF and Bugey to review the overall process for management of contractors to ensure that performance is in line with expectations.

Each department in Bugey's organization is responsible for maintaining the qualification of their personnel. A well established system is utilized for controlling the qualification of personnel. Regular interviews with personnel are performed by managers and individual training needs identified. The planning of training is done on a yearly basis and records are properly maintained in each department. Multi-skilling activities were observed by the team in several departments. Rotating personnel on loan for six months to special units in I&C-department was judged by the team to be a good example of skill enhancement.

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

Each department has adequate maintenance facilities both in the controlled and uncontrolled areas. They are orderly arranged and equipped. The workshops are clean and tidy, and have machinery of adequate standards. Work is orderly prepared in the workshops. For example, in the outside I&C workshop work is prepared for forced shutdowns with work preparation documents and required spare parts stored in special lockers for each pair of units.

The decontamination workshop and associated equipment are slightly above industry standards. Stores for chemicals for decontamination are orderly arranged and the amount of chemicals restricted.

Control equipment cabinets for the refuelling machines are dismantled after the completion of refuelling and taken to a special workshop for maintenance and post maintenance testing. Special machinery has been built to simulate movements of the refuelling machine. Training of the refuelling machine operators is also done with the equipment in this workshop. Steam generator mock ups are also available for training and practice of work.

Lifting devices and ladders are required to be inspected within a required time period. The team observed that this has not always been done and therefore recommend improvements in this area. This should include the control of contractor's equipment brought to site.

Calibration of other equipment, such as measuring devices in the mechanical, I&C and electrical disciplines was found to be carried out in an orderly manner and records maintained. Tool stores are well equipped, clean, orderly arranged and well managed. Special fire proof cabinets are available for the storage of chemicals and flammables in tool stores.

4.3. MAINTENANCE PROGRAMMES

A project entitled "Optimization of maintenance programme" is in progress with the objective of assessing the existing maintenance programmes, drawing up an action plan for the future and proposing an organization to establish future maintenance programmes. Preventive maintenance programmes have to be modified because Bugey will transfer to an eighteen month cycle following the completion of the forthcoming ten year inspection. Currently, most preventive maintenance is done during the outage programme. Predictive and diagnostic maintenance tools are also being assessed. The team encourages this effort to enhance the maintenance programme.

A condition based maintenance programme for various types of equipment has been developed to improve reliability, maintain a high level of safety and availability and reduce maintenance cost by optimising the preventive maintenance programme. Examples are:

- In the Valve/Boiler-Making Department, valve technicians test motor operated valves with computerized equipment named SAMIR;

- Regular vibration measurements are carried out on a large number of components by personnel from Rotating Machinery Department;

- Control rod movement and set points for the control rod position are checked with tools that they have developed on site;

- Oil samples from bearings, diesel engines, etc. are analyzed on site.

The programme is considered to meet current industry standards, however some initiatives such as those mentioned for I&C are an enhancement of normally used methods.

Preventive maintenance and In-Service-Inspection (ISI) programmes are managed by the work control system (SYGMA) and both programmes are based on corporate requirements. The ISI programmes comply with French national regulations.

All ISI reports and tests since original construction are stored in well structured archives. X-ray films, video tapes and records from non-destructive examination inspections are stored in a newly arranged archive with environmental control.

4.4. PROCEDURES, RECORDS AND HISTORIES

All procedures and work instructions have been reviewed and rewritten since 1992. However, no regular periodical review is performed, although several instructions and procedures have been updated due to performance experience.

The work instructions are clear and contain adequate information. They include hold points for checking during performance of work.

For each work order, a work file is prepare with required documents which includes procedures, instructions, assessment sheet, quality plan, radiation protection survey for the work site and a forecast of dose to personnel. After completion of work and evaluation the work file is archived.

A backlog of transferring the history of 4 800 work orders from SYGMA to the corporate experience feedback system (SAPHIR) exists. The team encouraged Bugey to reduce the backlog and in that way support corporate level to give timely experience feedback.

4.5. CONDUCT OF MAINTENANCE WORK

All maintenance activities are performed with work orders and work permits except from minor diagnosis work carried out by the I&C department. Work orders are prepared in SYGMA either from a work request generated from the preventive maintenance programme or a corrective work request.

The team observed work in progress and on several occasions noted the use of poor maintenance practices. The improper use of tools, the use of inappropriate tools, and adoption of practices that increase the risk of industrial accidents were noted. The team recommend that required standards for acceptable work practices be established, effectively communicated and enforced.

4.6. MATERIAL CONDITIONS

Recently, initiatives have been put in place to improve the material conditions. This includes introduction of a programme for walk downs by managers and supervisors. However, the majority of material condition deficiencies noted by the team were not included in SYGMA or in the inspection reports of managers and supervisors responsible for performing walk downs in the areas concerned. Deficiencies such as boron leaks from stuffing boxes, flange leaks, loose cable tray covers and oil leaks had not been reported into the system. A system to tag deficiencies has recently been introduced and could be seen in the plant. If fully implemented, this will readily identify deficiencies already reported. The team recommended that a comprehensive programme to detect, report and correct plant material condition deficiencies be implemented. Expectations for identification and reporting of deficiencies should be set up for this and effectively communicated to all staff.

4.7. WORK CONTROL

The maintenance programme is controlled by computer database in SYGMA that controls the corrective and preventive maintenance programmes.

There is a backlog of uncompleted work orders in SYGMA. The team encourage Bugey to examine the backlog in detail and remove completed work orders to history.

4.8. SPARES AND MATERIALS

Procurement, receipt inspection and storage for spare parts is established in procedures and responsibilities clearly defined. The spare parts are orderly marked with unique identification number and non-conforming material clearly marked with red signs. The warehouse is of adequate size and is well equipped with modern shelves and robotics. The team found that the spare parts were handled orderly, with shelf life clearly marked. The team encouraged Bugey to review their method of storing stainless steel plates to avoid degradation of materials.

Flammable and hazardous materials were noted to be stored properly in fire proof cabinets and orderly marked. In the warehouse, a large amount of wood was observed, while special training has been given to personnel in fire fighting and the store has been divided in zones. The team feels that the amount of wood to be excessive thereby increasing the fire risk in such stores that include spare parts important for safety.

4.9. OUTAGE MANAGEMENT

The preliminary outage periods are decided approximately one year in advance. Six months before the outage, a list of all activities from SYGMA is created and the outage activity co-ordinators from the various departments evaluate the content. Four months before the outage the list is frozen. All work identified thereafter is evaluated by the outage co-ordination group for inclusion. The decision not to include arising work in the outage must be authorized by the Technical Director. Normally, there are about 250 work requests submitted within four months of the outage. About 10 percent of these require a decision at the Technical Director level. The team found the control of work to be sufficient and the personnel well experienced to handle the work control. The outage organization structure is well defined and objectives and indicators are developed and trended.

STATUS AT OSART FOLLOW-UP VISIT

The plant has made progress on most of the maintenance issues. Of the three recommendations one is resolved, one shows satisfactory progress and one has insufficient progress.

The first issue was that the programme for control of lifting equipment and ladders was not adequate to ensure that inappropriate or defective equipment is not used. Strong measures have now been instituted to control ladders and lifting equipment. Inspections are done on a periodic basis and the devices are tagged showing that the inspection is up to date. This issue is considered resolved.

Another issue was work practices utilized by many station and contractor personnel involved in maintenance activities increase the risk of personal injury and damage to equipment. Contributing to this was a lack of oversight by responsible work area supervisors. The plant has responded to this issue by communicating eight commitments related to work practices. These commitments are enforced by discussions with front line supervision and management plant tours. Satisfactory progress is being made in this area.

The third issue concerned plant material condition. At the time of the OSART many material condition problems were not being reported, deficiencies were not tagged in the field, and many deficiencies in the plant were quite old.

Since the OSART, the operations department has begun a room by room review of material condition throughout the plant. Approximately 270 of 1800 rooms have been evaluated and the housekeeping in these areas has been enhanced. The more significant corrective maintenance issues have been reported to the Sygma system. Reporting of deficiencies has improved dramatically.

The plant has not focused the same attention on repairing the identified deficiencies. For example, leakage from equipment is identified and leakage containment is put in place, but in many cases the leaks are not repaired in a timely fashion. Because of this, the team felt that insufficient progress has been made with the issue of material condition. Management should clearly define its expectation that equipment deficiencies be repaired in a timely fashion. Field tours by managers should be used to personally assess conditions in the field and to personally communicate higher expectations concerning material condition.

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

4.2(1) Issue: The programme for control of lifting equipment and ladders is not adequate to ensure that inappropriate or defective equipment is not used.

In addition, the programme does not ensure equipment is tested or inspected within the prescribed limits. Some lifting equipment was observed in the plant that had not been inspected or tested as required. The following are examples:

- Travelling crane, 0 CRF 002 DG, in Unit 2/3 water intake area, was last tested on 17/09/97. The requirement is for cranes to be tested yearly.
- Records show that Turbine Building 3 travelling crane 3 DMM 006 PR was tested on 20/11/97 and then on 28/01/99. The limit was exceeded by two months and in this period the crane was not made unavailable for service.
- Unit 3 turbine hall slings were tested in December 1998, however some slings available in Unit 3 turbine hall had not been inspected or tested within prescribed limits.
- In Unit 3 Turbine Building, lifting slings to be utilized by a contractor were observed to be unlabelled and with their outer protective textile covers damaged.

Ladders are required to be inspected for deficiencies on a regular basis. Several ladders had not been inspected as required and some were not in a safe condition for use. Examples are as follows:

- Ladders were found in the basement of Unit 3 auxiliary building with the rubber anti-slide defective or missing.
- Ladders stored in the basement of Unit 3 auxiliary building for use with scaffolding were found that had no records of inspection.

Recommendation: The plant should ensure that all lifting equipment and ladders, that are available for use, are maintained in a safe condition and are inspected and tested as required.

Plant response (response given by: L. CHOMEL)

- <u>With respect to cranes, hoists and other lifting equipment</u>:

A comprehensive review of the situation is currently under way, and will be completed by 30th April 2000. This review, carried out by the fuel/logistics department, has enabled identification of non-conformances with respect to lifting equipment regulations. Treatment of non-conformances entails explicit removal from operation (placing of a sign) of the equipment concerned, or immediate compliance restoration.

– With respect to slings and eye bolts:

Given the findings made, which arose out of a fragmented system for management of statutory equipment condition, the management team of Bugey maintenance group decided to move toward centralized management of statutory checks on such equipment, even though storage takes place in different geographical locations. A review was carried out to compile an inventory of all such equipment. This involves three departments: the fuel/logistics department, the rotating machines department, and the Bugey decommissioning department. A "virtual" warehouse has been set up to enable administrative management using GEMO. 245 references have so far been input, with 1800 (managed in paper form) still awaiting input after being checked. For slings, the target date for completion of this work is set at 15th April 2000. For other types of lifting equipment (eye bolts, lifting beams, etc.), compiling a complete inventory takes more time and moves towards a situation of total compliance (identification, marking, checking and management) will continue until completion in 2001. Meanwhile, priority has been given to equipment that is used on a regular basis. To facilitate identification of tested equipment, the test result is indicated by a colored loop, which changes for each year. The color for the year 2000 is blue.

With respect to contractors, a clause has been added to orders which makes it mandatory for them to keep statutory test certificates at the plant, and make them available to EDF. Compliance with this clause will be checked by means of worksite inspections organized by the orderer or as part of management industrial safety plant tours.

– With respect to ladders:

The statutory situation is different for metal and wooden ladders.

For wooden ladders, regulations require us to have six-monthly tests carried out by an approved body. For metal ladders, no tests are required. However, the plant has decided to draw up a test procedure for metal ladders, and to perform annual tests on these ladders. The decision has again been taken to centralize management of this testing using the fuel/logistics department's GEMO application. All departments are concerned by this measure; tested equipment is indicated by means of a disk tag attached to it (since 29th February 2000). Steps or stepladders with 3 steps or less are not concerned by this measure. Wooden stepladders and ladders used by contractors are subject to the same regulations: contractors must ensure that their equipment is tested. This is checked by the orderer. With respect to metal ladders, the EDF test procedure will be sent to contractors to enable testing.

With respect to ladders attached to scaffolding, condition testing is carried out by the site civil works department on acceptance of scaffolding. Such ladders are identified by the marking “BUM\SGS EC”. The result of such testing is indicated by means of a label indicating the date of the next test.

– With respect to forklift vehicles:

Vehicles, trailers and containers are currently in the process of being identified. The principle adopted is that of assigning an equipment ID in the SYGMA equipment database. Record codes are currently in the process of being created by the fuel/logistics department. Physical marking will be carried out once the codes are available (scheduled for mid-April).

All of this organization will be set out in a memo currently being prepared by the fuel/logistics, site civil works and rotating machines departments.

IAEA comments:

The plant has instituted periodic tests for slings and ladders. These tests have been completed and the acceptable equipment is marked by a colored loop. The color of the loop changes each year so that it is possible to determine if the device has been tested within the appropriate time period. In the case of lifting equipment an inspection program has also been implemented. Unacceptable equipment has been withdrawn from service. A database is maintained so that the status of a particular piece of equipment can be easily determined.

Conclusion: Resolved

4.5. CONDUCT OF MAINTENANCE WORK

4.5.(1) Issue: Work practices utilized by many station and contractor personnel involved in maintenance activities increase the risk of personal injury and damage to equipment. Contributing to this is a lack of oversight by responsible work area supervisors.

The following are examples of poor maintenance work practices that were observed:

- In Unit 3 fuel pool cooling equipment area, a worker dressed in forced fed air hood and other plastic anti-contamination clothing stood on a pipe, and used an adjustable wrench on nuts while the threaded stud was gripped with vice grip pliers.

- In Unit 2/3 pump house, a worker using a small hammer and chisel to dismantle a brass ring in a pump without wearing eye protection. A screwdriver was also used as a chisel.

- A worker attached a large open wrench to the underside of the flange bolts of heat exchanger 9 TEP 004 RE and while holding the wrench with one hand and supporting it between his legs, used an air driven socket wrench to remove the upper nuts. If the nut had seized onto the bolt, there would have been the potential for a significant personal injury.

- The vertical poles of a scaffold in Unit 3 electrical switch room passed through an overhead cable tray. The installed cables had been displaced to accommodate the poles.

- During a fuel pool water filter change on Unit 5 (N332-4 PTR 01 F1) one worker, not wearing plastic anti-contamination clothing or rubber gloves, physically lifted the heavy wet and contaminated filter body from the crane holding it against his body and placed it into a transport trolley.

- Personnel were observed sitting on cable trays while installing new cabling in room L 540. Internationally, there have been significant and fatal accidents caused by inadvertently puncturing electrical cable insulation while working from cable trays. Cable trays are typically not designed to support the weight of a person and may be subject to distortion allowing internal cable damage and degradation of important systems if these practices go uncorrected.

- A worker straddled a one meter gap between the top of the access ladder and the top of the pump motor of Unit 3 reheater drains return pump to work on the motor body. No safety harness was worn and the unprotected drop below was approximately three meters.

- A worker calibrating a sensor on 2 RIS 130 MD was working from a ladder which had not been tied off, the top of which was resting within one centimeter of the bottom of a pipe support.

- Another worker was working from a ladder that was resting on cables and was also not tied off in Unit 3 turbine building.

Supervisory staff were present in the vicinity of the work site while many of the above practices were used and in several instances did not correct the improper practices.

The use of poor maintenance practices increases the risk of personal injury and equipment damage that has the potential to affect plant availability and nuclear safety.

Recommendation: Management should take steps to ensure expectations for the conduct of maintenance are clearly understood and personnel are held accountable. Maintenance personnel, including contractors, and supervisors should be provided with the necessary knowledge and skills to perform the work properly and identify deficient practices.

Plant response (response given by: L. CHOMEL**)**

As findings in the area of maintenance highlighted a lack of industrial safety culture, which is confirmed by our own results, plant management decided to focus effort on improving this situation through the implementation of an “Industrial safety/plant housekeeping” project. As these improvements are based on clear expression of plant requirements in this area, eight “commitments” were decreed in February 2000. These included one concerning the commitment to report potential hazard situations and one concerning the use of tools. Failure to comply with these commitments leads to sanctions.

The level of management presence in the field was also considered inadequate across the board, and its organization excessively diverse (“green helmet” tours, field inspection rounds, management field tours). As the range of visits, with no guarantee of feedback between them, had failed to deliver the expected results, the plant moved toward implementing a single type of formalized inspection: management industrial safety plant tours. These are carried out, regardless of plant operating status, by the client departments, and will also involve contractors. The inspections are conducted by members of department management teams, who have been trained in identifying anomalies, and cover industrial safety, professionalism of work performance, and compliance with all plant regulations. The majority of anomalies identified are handled by the departments, while those which are cross-functional in nature or related to organizational aspects are handled at plant level. Management industrial safety plant tours began in January 2000. Training of department management team members in observation techniques is ongoing, with a target of 180 people trained by

15th May 2000. Following up on the findings made with respect to industrial safety and professionalism of work performance will enable measurement of improvement in the situation over time.

Above and beyond this baseline activity, which is marked by increased management presence at worksites, and on the basis of anomalies detected during the OSART, the valves/boilermaking and site civil works departments have initiated specific actions:

– In the valves/boilermaking department, a tool catalogue has been created, with a view to reminding maintenance workers of the rules concerning the use of tools. Presentation of the catalogue to department teams, and integration and application by the teams, are scheduled to begin in May;

– In the site civil works department, an analysis has been initiated with respect to maintenance and handling of filters. A "reflex sheet" has been drawn up for this type of handling operation, to eliminate the practice of handling such filters by hand, thereby avoiding both the contamination of maintenance workers as well as industrial safety risks.

IAEA comments:

Measures have been established to improve the worker's knowledge of requirements, implement better work practices, and to monitor the practices in the field. Eight commitments, which summarize management's work practice expectations, have been introduced within each department. In order to increase acceptance, workers are given a chance to discuss these commitments with their supervision. With a few exceptions, workers appear to be implementing these commitments in the field. The exceptions we noted were the use of eye protection when grinding and the use of gloves in the radiological area.

Tool catalogues that specify tool applications are in use.

A program of management industrial safety tours to monitor the implementation of the improved worker practices has started. Although 120 people have been trained to perform tours only 330 tours are planned annually. Consideration should be given to expanding these field tours. Management field tours offer a unique opportunity for managers to communicate expectations concerning work practices. Although the plant has published posters and pamphlets it is necessary for managers to frequently discuss expectations with workers in a face-to-face manner.

Conclusion: Satisfactory progress to date

4.6. MATERIAL CONDITIONS

4.6.(1) Issue: Material condition problems are evident on many systems throughout the plant. In a sample of material condition deficiencies, many were found not to be included in the plant work control system (SYGMA). Contributing to the lack of identification of defects is that the plant has not utilized a deficiency tagging system until recently. Operators stated that they found the new tagging system to be difficult to apply and it only applies to leaks. Therefore, it is difficult for operators to recognize which deficiencies have already been reported**.**

Also contributing to the lack of deficiency identification is the general staff perception that operations staff are the only personnel responsible for reporting deficiencies. The management expectation is that everyone is responsible for reporting deficiencies to SYGMA. However, while this is written in an organisational memo for maintenance, it has not been clearly communicated to all personnel.

Many examples of the material condition problems that were identified by the team were old and were not reported by operators or other station staff. Of the 50 checked, only 10 were included in the work control system.

The following are examples of material deficiencies that were not reported:

- Boron leaks that have led to corrosion of gland and bolts for valve stuffing boxes (4 EAS 246 VB, 2 RIS 145 VP, 3 RIS 032 VP, 2 RCV 818 VP, 2 RIS 818 VP);
- Gland leaks on valves and pumps (0 SVA 027 VV, 0 SVA 028 VV, 0 SCA 001 PO, 3 GSS 010 VL);
- Valve and pipe supports not properly installed (3 GRV 001 RF, 2 ANG 019 MP, GSS 852 VL, 3 RCV 872 VH);
- Leakage from flanges (3 RIS pump, RRI 102 VN);
- Cable shrouds that have come away from connecting boxes, leaving the cable unprotected and unsupported (3 GPV 023 VV, 0 DVNa 052 VA);
- Loose cable tray covers (3 RRB 102 AR), unsupported cable trays and loose cables (e.g. unit 2 between B23 and C22 pillars), vertical cable tray cover loose and falling off (N283);
- Cabinet doors which are highly distorted and that cannot be closed (2 RIS 024 CR, 2 RIS 025 CR);

– Throughout the auxiliary buildings there were many examples of drain pipework that had not been correctly installed or replaced. This increases the potential for uncontrolled spillage of radioactive fluids. For example on the Safety Injection System of Unit 2, 2 RIS 257 VP the pipework to drain had not been replaced. The pipework from 2 RIS 258 VP to drain had only been partially connected.

The station implemented a system about two years ago that assigns responsibility for material conditions and housekeeping for plant areas to individuals within work groups. The current allocation of responsibility is very general with little managerial control over the process and the system has not yet been effective. The station had recognized the need to enhance this system.

Recommendation: A comprehensive programme to detect, report and correct plant material condition deficiencies should be implemented and the associated expectations clearly communicated.

Plant response (response given by: L. CHOMEL)

Three main lines of approach were adopted to respond to this recommendation. These lines of approach are implemented via the "Industrial safety/plant housekeeping" project, which was set up in the last quarter of 1999.

– Comprehensive detection:

The operations department, having had its position as plant "owner" clearly reaffirmed, is carrying out a comprehensive inventory of the condition of equipment and the environment on a room-by-room basis. This inventory began in September 1999, and is ongoing. 1546 files have so far been prepared (each file corresponds to a single room), and 208 field inspections have been carried out.

– Correction:

The findings made in these files lead to:

– either issue of a work request in the SYGMA work control system if treatment necessitates use of specific procedures,
– or input into a networked "LOTUS" database, with follow-up by the "power operations" structure, where the item can be treated without an extensive prior analysis (for example: brushing, cleaning, retouching of paint, heat insulation repair, etc.). Anomalies concerning labeling are processed directly by the operations department. This database currently contains 675 items, 405 of which have already been treated.

Correction is the responsibility of the equipment owner in the first case, or of a designated department or a rapid response job team (currently being put together) in the second case. Each week, a field visit coordinated by a member of the plant management team enables ensuring that the compliance restoration deadlines for rooms, set by the power operations structure, have been respected.

– Maintenance of condition over time:

To combat the causes of deterioration in equipment condition over time, two measures were adopted:

– It was decided to give the operations department responsibility within the process of identifying and collecting miscellaneous leaks. Identification is via a yellow tag placed as close to the leak as possible, and removed by maintenance staff on completion of the work to correct the problem. Leak collection is carried out using specific equipment produced by the valves/boilermaking department and provided to operations.

– It was decided to make the maintenance departments responsible with respect to the non-deterioration of equipment and environment through worksites. This point is still at the analysis stage, although current investigations are moving toward optimization of worksite setup and closeout reports and improved presence of EDF staff (management and supervisory level) in the field. This would allow actions to go beyond simply restoring the condition prevailing at the start of the worksite, to enable improvement of the general condition of the equipment or the equipment and the room.

IAEA comments:

Operators are performing a room by room review to identify deficiencies in the material condition of the plant. At this time, approximately 270 rooms of 1800 have been evaluated. Teams have been organized the fix labels, coatings and other problems not involving the operation of plant equipment. More significant deficiencies are reported by way of the Sygma system.

Repair of the more significant plant equipment problems has been slow. Repair strategies in some cases will not be available until September. The maintenance department remains in the analysis stage concerning what they will do regarding their responsibility with respect to the non-deterioration of equipment and environment through worksites. Some of these deficiencies require engineering solutions. These solutions have not been developed.

Numerous leaks exist throughout the plant, including leaks of contaminated fluids. The plant focus has been to contain the leaks rather than to eliminate the leaks at the source. Despite the length of time since the OSART, the plant is still at the stage of developing its strategy for tracking leaks.

Contractors prepare close out reports that list equipment deficiencies, however these deficiencies are not captured by the SYGMA system.

If identified deficiencies are not repaired in a timely fashion, the workforce will lose the motivation to report deficiencies. The good work that has been done to improve the reporting process will be lost. It appears that management tolerates degraded equipment. The expectation of management should be higher and this higher expectation should be communicated through frequent visits to workers in the field.

Conclusion: Insufficient progress to date

5. TECHNICAL SUPPORT

5.1. ORGANIZATION AND FUNCTIONS

The organizational structure is defined and understood, however, it is complex with a significant involvement and dependency on corporate departments for technical support matters. There are numerous interfaces between the plant and corporate departments and these are managed through the Technical Support Manager by representation on corporate technical committees.

Technical support at the plant is distributed within the maintenance and production departments. Technical issues are coordinated and managed through the use of cross site technical committees. These committees also evaluate the impact of corporate technical support recommendations on the plant. Nuclear safety is the first priority of the sections active in technical support activities.

The plant had developed a strategic plan to cover the period 1996 to 2000 and overall targets have been set, many of which are safety related and which technical support had a significant impact upon. The targets are monitored regularly and reviewed at management level periodically.

Communications with operating departments are particularly effective and utilize question and answer sheets for the provision of technical information. These are verified and approved and are widely available on the local computer network.

5.2. SURVEILLANCE PROGRAMME

The surveillance programme is defined by the corporate technical support. It defines the test rules which state the periodicity and acceptance criteria for the test programme in order to ensure that the nuclear safety requirements of the general operating rules are satisfied. The plant draw up the associated test procedures and test tables. The Safety Authority approves the test rules and test tables.

The Safety and Quality Department coordinate the development of the test procedures and test tables, and review them to ensure that the nuclear safety requirements are met. They have also developed a database which lists all the tests, their periodicity, the responsibilities for performing the test, the procedures to be used and the acceptance criteria. This database is available to all departments.

The surveillance tests are managed through the plant work control system SYGMA database and are scheduled by a central planning department. There is a commitment by the plant to achieving the planned testing programme and the tolerance margin is seldom used. Tests where the results do not satisfy the criteria are analyzed, reported and appropriate actions taken. This process involves informing the shift supervisor so that plant availability requirements can be satisfied. If changes to the test requirements are needed, submissions are prepared for safety authority approval prior to implementation.

The operational departments check that safety and quality requirements are achieved by the tests. In addition, there is a programme of random checks by the Safety and Quality Department to ensure consistency with the general operating rules. The results of the surveillance programme are used to perform an annual reliability review of the safety systems. This is reviewed by the site safety committee.

5.3. OPERATIONAL EXPERIENCE FEEDBACK (OEF) SYSTEM

Commitment of the plant to operational experience feedback is high with a central OEF coordinator and staff trained in OEF in each department. There is also a human factors consultant in the Safety and Quality Department. There is cross departmental coordination of all OEF information by an event review committee. This body also reviews external events from EDF and the rest of the nuclear world identified on the corporate database.

In house nuclear safety related events are analyzed and entered into a company wide database SAPHIR. The reporting criteria for significant and safety related events are stipulated in corporate documents. Deviations found during testing and surveillance are recorded within the department responsible for the tests and are entered on a database SYGMA. There is no uniform approach to recording such events on the OEF database and there is a large backlog of entries in the maintenance area. There are a number of separate databases used in the plant to record such information, however there is no site overview of these events. There is no guidance for reporting of low level events particularly those involving human factors or near misses rather than equipment failures, with the result that long standing plant problems persist such as a high level of personal contamination and industrial safety problems. The inability of the plant to trend precursors of more significant events could mean that corrective action plans will not be fully effective and the team recommended a consistent approach in this area.

The plant has paid significant attention to previous significant operating events and reactor trips and has achieved continuous improvements over the past three years. Action plans have focused on the root causes, which are analyzed using a corporate methodology. However, here is no systematic method of trending of events for human factors problems. This makes effective analysis of the database time consuming, other than for small numbers of events, and may lead to a focus on equipment failure problems.

Communication on OEF issues is good with weekly reports from the Operations Department and the Safety and Quality Department on plant events and deviations. These reports are widely available on the local computer network and are used for team briefings. All incident investigations are also available on this network. The team found that staff were aware of recent significant events in their areas.

5.4. PLANT MODIFICATION SYSTEM

There are two classes of plant modifications; Corporate which apply to all plants (note Bugey and Fessenheim have some unique features) and local which apply only to Bugey. The philosophy is to limit modifications to those required to bring all EDF plants to the same standards and to have as few local modifications as possible.

The strategy, design and procurement of all corporate modifications is done by corporate engineering with a review by the plant at all stages. Modification proposals are reviewed and approved by a site wide modifications safety technical committee, the GETM. Modifications are implemented under the control of the plant’s new works structure and the work is generally performed by contractors. There is a focus on ensuring document changes are identified and completed before the modification is put into service. There is a formal hand over procedure (requalification test certificate) and a final review of the modification by the safety committee, the GTS. Work that was examined appeared to be well controlled.

Some problems with the control of obsolete equipment were observed including electrical cables which were neither labeled as redundant nor sealed (for example cables 2LCA012CR and 2CRF01BA) and test equipment still installed on the plant after the tests had been completed. One example of the latter problem involved a test facility in the turbine hall basement on Unit 2 which had been installed in 1986 to perform tests on steam condensation on turbine blades. Another example was test equipment installed on unit 2/3 auxiliary steam deaerator. The test and measurement team were not aware of the reason for it still being in place. The team recommended improvements in the control of obsolete equipment.

There are a large number of temporary modifications (DMPs) in place (134 across the four units). Some have been in place for a significant period. For example, there are more than 50 which have been in place greater than three years. One has been installed since 1987. Many require corporate engineering support to resolve the technical issues and modifications are planned for the coming ten year outages, but some require simple technical solutions. The current review process does not ensure timely removal of this type of modification and the team recommended improvements in this area.

5.5. REACTOR ENGINEERING

The corporate Engineering Support for Operation Fuel support group UNIPE BC (Branche Combustible) performs most of the reactor engineering tasks as a service to Bugey. They provide loading patterns for new fuel cycles, safety analyses, calculation codes and the start up test file and start up tests. It was noted that the start up tests were significantly more onerous than those performed at similar pressurized water reactors (PWRs) in the world and took approximately 2.5 days longer than those at North Anna in the USA which is similar in design. EDF had appealed to the Safety Authority for a similar testing regime but this request was not granted.

The plant has recognized the need for more local support and expertise in the area of nuclear engineering and has recently created a neutronics engineering position with the aim of providing enough expertise and understanding to aid in the judgement of nuclear safety and operational issues, but not to perform detailed calculations. Training for this post has been specified and includes simulator training. The training and competence requirements are specified in corporate guidelines.

Reactor engineering tests are specified by the corporate group but carried out by the Plant Testing and Measurement Section. The tests are well documented and any deviations analyzed. All the staff interviewed appreciated the importance of their rôle in maintaining high standards of nuclear safety. The results of the reactor engineering tests are trended and communicated to operations staff.

There is currently a leaking fuel element in Unit 4. Leaking fuel is unusual and it is currently being monitored and is within the limits for reloading of fuel. Discussions confirmed that a conservative approach has been adopted and corporate advice taken.

5.6. FUEL HANDLING

The corporate fuel delegation group DAC are responsible for the procurement of, and specification of checks on new fuel. The suppliers perform the checks and are present at the site when fuel is received. There is a single department on the site for the handling and management of fuel. This strategy is good in that it establishes clear responsibilities in a sensitive area.

Handling of the fuel is carried out by trained staff who understand the significance of the risks associated with the complex operations and equipment. There is a training facility available to rehearse handling operations. Staff interviewed, demonstrated a conservative approach when asked about actions to be taken in the event of plant problems and understood the procedures for applying temporary modifications. Fuel records are well documented and recorded on a corporate database.

An inspection of the fuel handling facility did not reveal any concerns regarding foreign material exclusion in the fuel storage pool, but temporary storage of some flasks containing used filters could be improved. Otherwise the facility appeared to be well managed.

The site has recognized the importance of this area on its performance and developed an action plan which involves improvement activities for all of the major departments involved including those in the corporate organization. The plant are piloting a protocol agreement with UNIPE for their support in reactor engineering activities.

5.7. SAFETY RELATED COMPUTER APPLICATIONS

Safety related computer applications fall into two areas; industrial data processing and management information systems. Each are managed by different departments. It was noted that direct operational safety did not rely on any computer application. Changes to monitoring parameters due to plant modifications are carefully controlled and tested and communicated to operations staff before implementation.

There is an important relationship between the plant and corporate for both software and hardware support. A main contractor supplies both services at a corporate level and locally through a call off system. Developments of software are performed at corporate level which can lead to delays in improvements of databases. A particular example is the A22 database used for chemistry data which is due to be upgraded to MERLIN next year. All databases are to be upgraded to ensure millennium compliance. An upgrade to SYGMA is planned for June.

Availability criteria have been specified for important systems such as the work control database SYGMA and the tagout control database (AIC) which is used by operations. It was noted that interfaces with corporate departments and the contractor were good and the contractor was fully involved. A partnership approach was being established to ensure continuity and security of support for these important systems to the safe operation of the plant.

STATUS AT OSART FOLLOW-UP VISIT

The plant has made good progress on Technical Support issues. Of the three recommendations one is resolved and the remaining two exhibit satisfactory progress.

One issue was that there was no station wide structured programme to capture, document and trend minor events for identification of corrective actions. During the follow-up it was determined that the detailed plant reviews by operations identify many low level equipment problems. Low level events are tracked within the individual departments and are reported to the operational experience feedback committee based on Saphir criteria or at the discretion of the department. Low level events should be evaluated on the plant wide basis since some precursors may not be unique to an individual department, but rather could indicate a plant wide weakness. In the industrial safety and radiation protection departments reporting of low level events is prevalent. Although reporting appears to be less consistent in other departments, satisfactory progress is generally being made.

Another issue was that there were numerous cables in the station that were abandoned, that were not marked or effectively sealed. The policy for the removal of obsolete equipment was not adequately defined. Since the OSART a detailed methodology has been implemented to address this issue. Removal of abandoned cables in the field is progressing well. And a process is in place so that new modifications will consider the removal of decommissioned equipment.

The final issue was the review process for temporary modifications (DMPs) did not ensure timely removal which could have lead to confusion for the operations and maintenance staffs. At time of the OSART there were 134 temporary modifications applied on the plant some of which had been in place for significant periods. Temporary modifications are now marked in the field and analyses have been done to determine if they are required. If not required they are removed. If their function is still required, plans are made to replace them with a permanent modification.

The plant does not have a goal or management expectation for the maximum number of temporary modifications that should be allowed in the plant. There are no clear expectations for the maximum time that temporary modifications should be allowed in the plant. The technical production group should continue to provide guidance on minimising the number of temporary modifications and the length of time they are installed.

5.3. OPERATIONAL EXPERIENCE FEEDBACK (OEF) SYSTEM

5.3(1) Issue: There is no station wide structured programme to capture, document and trend minor events for identification of corrective actions. The lack of a systematic approach to low level event reporting impacts the amount of information available for trending of problems. Root cause analysis of these precursor events is therefore not performed to identify appropriate improvements and to maintain the effectiveness of current action plans. Many minor events, including near misses, low level industrial and radiological safety events are either not reported into a database and/or trended. The following are examples:

– Procedure deficiencies;

– Valve isolations and tagging errors;

– Improper radiological practices;

– The large number of contaminations detected at the exit to the RCA;

– Poor industrial safety practices and minor accidents;

– Industrial safety hazards.

Recording, analysis and trending of low level events will assist in validating the action plans put in place to address the root causes of past significant events. In addition this data will help identify any additional factors which can be incorporated into the plant's self assessment and management inspection programmes.

Recommendation: The station should enhance the operating experience programme to include a programme to document and trend low level events including near misses which is coordinated across the station.

Plant response (response given by: J.P. LE ROUX)

Plant management has decided to:

– Extend the area currently covered by experience feedback to cover low-level events, near misses, industrial safety and radiation protection, and to integrate the corporate memo ref. DI 103 called "Follow up of failure of important equipment in pressurised water reactors".

- Adopt the following criteria (for actual or potential events) when it comes to:
- nuclear safety: the criteria defined in corporate memos ref. DI 19, 30, 55, 60 and DI 103 regarding equipment failure;
- radiation protection: events concerning contamination of individual staff members, equipment and roadways, as well as radioactive liquid or gaseous leaks that have resulted in staff members' internal or external radiation exposure;
- industrial safety: occurrences that may entail injury to staff members' or any potentially hazardous situation;
- the environment: events that may have consequences in the media or on the population.

- Identify, record and store all these events in the departments with the appropriate collection tool, whatever their severity level (experience feedback data sheets or equivalent, in line with the organisation memo entitled "Management and processing of experience feedback" ref. D5116/NO/93007), and use SAPHIR and SYGMA each time it is deemed useful, in compliance with corporate memos ref. DI 19, 30, 55, 60 and 103.

- Carry out a trend analysis and/or analyse the causes each time similar events occur on a repeat basis, and at least once a year when activity reports are prepared. Identification of low-level events or precursors is done within each craft area with the participation of workers. Each craft chooses relevant indicators for the follow up of low-level events or near misses in each area covered, and looks at their origin including possible human performance issues.

The plant organisation memo ref. D5116/NO/93007 and entitled "Management and processing of experience feedback" has been updated by integrating the decisions taken.

Each department manages low-level events or near misses that have an impact on that department or for which it bears responsibility. It follows up these events and near misses and presents those that are cross-departmental or generic at the experience feedback committee (COMEXSI) meetings, so that all relevant departments are informed thereon.

The industrial safety & radiation protection department has set up an organisation for collecting all events so as to carry out necessary analyses. Results are gathered in two sets of indicators, one for following up on working accidents and the other for radiation exposure/protection. It is worth pointing out to the significant drop in the number of contaminated persons when exiting the RCA at the C2 monitoring portal.

Analysis of the C1 monitoring portal control results have shown that a greater number of contamination events are attributable to one department (fuel and nuclear logistics department -SCL). Investigation into the causes of this is being undertaken following a request made by plant management.

IAEA comments:

The plant experience feedback committee is functioning as the clearinghouse for low level events which have generic application across department boundaries. The Sygma system is used as a reporting system for equipment related issues and the Saphir system is used for work practice and programme related issues as well as equipment related issues.

Low level events are tracked within the individual departments and are reported to the operational experience feedback committee based on Saphir criteria or at the discretion of the department. In the industrial safety and radiation protection departments reporting of low level events is prevalent.

Reporting appears to be less consistent in other departments. For example, in the maintenance area, at the conclusion of a job contractors prepare close out reports which list remaining deficiencies. However these deficiencies are not recorded in the Sygma system and no further action is taken regarding them.

The plant should consider expanding the present reporting practices of the safety and radiation protection department to other plant departments. If workers declare the minor events that occur, an analysis could be done on these events which might enable the plant to discover programmatic weaknesses. Resolving the programmatic weakness would help avoid bigger events.

In addition low level events should be evaluated on a plant wide basis since some precursors may not be unique to an individual department, but rather could indicate a plant wide weakness.

Conclusion: Satisfactory progress to date.

5.4. PLANT MODIFICATION SYSTEM

5.4(1) Issue: There are numerous cables in the station that appear abandoned, that are not marked or effectively sealed. In addition, there are many other pieces of obsolete equipment that have not been removed or clearly identified. The policy for the removal of obsolete equipment is not adequately defined. This has contributed to obsolete electrical cables which are not identified or adequately sealed, with the potential for injury to plant personnel and confusion for operations and maintenance staff.

The present plant policy for the management of electrical cables does not address the removal or sealing of obsolete cables and the policy for the removal of obsolete equipment is not sufficiently defined.

Several examples of test equipment installed as plant modifications were still in place on the plant although the tests had been completed or abandoned. One example was installed in 1986 and involves a testing facility in the turbine hall basement which had originally been used for tests involving condensation of steam on turbine blades. Another example is temporary equipment connected to the back of the auxiliary steam deaerator 0STR001DZ. The equipment is no longer in use and the test and inspection team were not aware of its purpose.

Recommendation: The plant should establish and implement a clear and consistent policy for the management of all obsolete electrical cables and equipment. This policy should specifically address obsolete cables that have not been removed or adequately labelled and capped.

Plant response (response given by: J.P. LE ROUX)

All relevant departments gave thought to this recommendation in June 1999, which led to plant management deciding that this issue would be handled in two distinct parts: completion of the existing backlog and setting-up of an organisation for managing current and future situations.

Completion of the existing backlog:

The findings made at the plant reveal defects at various levels:

- cables, apparently unused, are neither labelled, protected nor correctly cut,
- some cable running trays are over-packed with cables overflowing the running trays,
- some cable fixing brackets are damaged.

It has been decided to give the priority to upgrading this situation in the following sequence:
1. withdrawal from use of cables,
2. correct repositioning of cables within the cable running trays,
3. upgrade of cable fixing brackets.

Upgrade work started during summer 1999. At the beginning of March 2000, approximately 90% of such work was completed, and should be completely finished by the end of the first half 2000.

When unused cables are withdrawn from use, the cables are removed up to the main cable running tray after a specific label and heat shrinking end cap have been affixed to the end of the cables.

The "Pericles" data base on cable management is subsequently updated.

<u>Management of current and future situations</u>:

This area is divided up into two topics: how this recommendation is treated at corporate level and at the plant.

Corporate treatment:

Investigations showed that there is no requirement in contract-related documents appended to corporate contracts. A letter was sent by the STN (plant) to the CLI (corporate engineering) on 11th June 1999, requesting the CLI to state its position as to the processing method suggested by STN and to communicate the actions to be implemented.

Plant specific treatment:

Bugey applies a procedure for the withdrawal from use of cables:

1. identification of the cable to be withdrawn from use by testing it at both ends,

2. the cable is cut at both ends at the level of the main cable running trays,

3. a heat shrinking end cap is fitted at both ends of the cable,

4. a label entitled "Removed from use" is put at both ends,

5. update of the Pericles data base.

This procedure is particularly suited to cable withdrawal as the solution is quick and easy to carry out. A technical memo ref. "D5110/NT/99078" defining the operating techniques necessary to remove cables and equipment from use was drawn up and distributed in April 2000.

IAEA comments:

The plant has approached this issue from two fronts. The first is to address existing problems, the second step is institute programs that will permit the plant to avoid future problems in this area. A methodology has been developed for the proper way to decommission cables. The process involves trimming the cable back, applying heat shrink and labeling the cable. This process is in progress.

Each new modification is reviewed and if cables are to be decommissioned the proper steps for doing so are included in the modification.

Conclusion: Resolved

5.4(2) Issue: The review process for temporary modifications (DMPs) does not ensure timely removal leading to the potential for confusion of operations and maintenance staff. There are currently 134 temporary modifications applied on the plant some of which have been in place for significant periods including more than 50 for over 3 years. 9 RI 07784 has been in place since 1987 on the circulating water cooling system and involves the disconnection of a differential pressure sensor used to measure sludging in the condenser tubes and to automatically control the cleaning system. Manual cleaning of the tubes is now used. A request for a plant modification to remedy the problem had been rejected. Others, 9 RE 07373 and 9 RE07374, have been applied to boron water make up tanks and involve the inhibition of a sensor which provides an on/off signal to a pump. The level in the tank is now controlled by an analogue device and there are no plans to reinstate the sensor.

Comprehensive risk analyzes for old DMP's were not always available.

Some of the temporary modifications require the use of temporary operating instructions for operations staff. Temporary modifications have the potential for confusion for plant personnel and can contribute to events. An event at the plant in 1998 was directly attributable to the use of a DMP.

Many of the problems which have resulted in the application of a temporary modification require corporate engineering solutions and are awaiting resolution. However, many temporary modifications have not been removed in a timely manner or incorporated into a permanent modification. The existing review programmes have not been effective in resolving temporary modifications.

Recommendation: The plant should institute a process which ensures that temporary modifications are regularly reviewed with the intent that the need for the modification is justified, the risk assessments are validated, and the technical problems are resolved as quickly as possible.

Plant response (response given by: J.P. LE ROUX)

Plant management has decided to:

– Have the technical production committee (which is a recognized entity) analyze all existing temporary installations (DMP) so as to suggest adequate processing of these DMPs in strict compliance with the plant quality assurance manual and DMP-related corporate instructions (keeping them in place, final removal, modification request, risk analysis).

– Regularize - via the modification request system - DMPs where rules entail a permanent modification;
– Carry out a risk analysis of old DMPs that had not been subject to a risk analysis at the time when they were originally installed;
– Add a checking stage to be carried out during the meetings of the technical production committee concerning the processing of any new DMP scheduled to have a long life (in excess of 3 months).

The first two items on the list are complete. Review by the technical production committee started in September 1999. Suggestions for modifications were formalized by the technical modifications study group in January 2000. All in all, the suggestions made will make it possible to get rid of 47 DMPs this year, of which 23 will be permanent modifications.

The risk analysis of older DMPs is under way. Each department has indicated its position on this specific point: the plant memorandum on this specific subject is currently being revised and will be distributed soon. This update will clarify the management of DMPs related to a maintenance activity, improve traceability of risk analyses (indication of SYGMA reference on the DMP work permit) and will include the new checks.

IAEA comments :

The plant has reviewed each of the existing temporary modifications. This analysis has determined why the modification was installed, if it is still needed, and by what method it will be removed. When new temporary modifications are developed, the engineer is required to determine the way in which the temporary modifications will be managed to resolution.

Action is underway in the field to remove temporary modifications. Six of the seven modifications planned for removal in the unit 3 outage were in fact removed.

The plant does not have a goal or management expectation for the maximum number of temporary modifications that should be allowed in the plant. There are no clear expectations for the maximum time that temporary modifications should be allowed in the plant. The technical production group should continue to provide guidance on minimising the number of temporary modifications and the length of time they are installed.

Conclusion: Satisfactory progress to date

6. RADIATION PROTECTION

6.1. ORGANIZATION AND FUNCTIONS

The Plant Director has overall responsibility of the radiological protection programme at Bugey. This responsibility is further delegated to the Safety and Radiological Protection Department (SRP) which functionally reports to the Manager, Safety, Quality and Radiation Protection but fulfil the responsibility for radiological protection under the Deputy Plant Director.

Performance in the area of collective radiation dose has improved significantly during the past four years at Bugey. The station has a formal structured ALARA committee which work very closely with the contractor organizations at the station. The committee includes representation from each organization which has workers who enter the radiological control area (RCA). The committee has established specific initiatives for dose reduction, as well as a financial budget to be used for dose reduction initiatives. The Deputy Maintenance Manager is the chairperson of the ALARA committee and is committed to the success of the committee.

Additionally, in 1998 Bugey established a Radiation Exposure Committee to focus specifically on monitoring and improving dose performance during outage periods.

Each department manager is responsible for managing the dose for their organization. They are held accountable for managing and achieving their dose budgets just as they are for their financial budgets and include dose as a performance indicator in their department specific monthly performance monitoring reports. Dose is included in the Bugey monthly indicator report. However, when discussing long range vision with senior management at Bugey, it was not evident that a long range goal for dose (i.e., better than the mean of EDF plants) had been established.

EDF has established an annual administrative policy of 18mSv/12 months to meet the current statutory dose limit and new proposed regulation. Bugey has decided to use a more stringent policy of 16mSv/12 months to provide additional administrative control. This indicates the stations commitment to not only address collective dose but individual dose as well.

The responsibilities for implementing various aspects of the radiological protection programme have been divided among various organizations at the station. While some level of ownership for the programme exists within the various departments, there were also examples of where radiological performance was not meeting established expectations and accepted industry standards. The team recommended strengthening the overall site management and overview of the radiological protection programme by the station and recommended improving radiological work practices in the field.

6.2. RADIATION WORK CONTROL

All radiation workers are trained and qualified by a standard method within France. They receive standardized training (RP level 1 or RP level 2), based on the level of work they will be performing, to ensure they have adequate knowledge and skills to be able to perform self-coverage adequately. Work is planned in advance and the station utilizes a permit process for work that requires entry into orange areas, red areas, containment entries at power, and any other specific radiological condition that requires additional radiological protection considerations. This permit has specific authorization requirements and includes a dose estimate for the work along with other pertinent information. The SRP organization is actively involved with the planning and execution of work in the RCA.

The physical layout of the RCA access points is such that entrances and exits utilize the same general area. This has the potential for cross contamination of personnel entering the RCA prior to being fully dressed in protective clothing. The team recommended that this layout be re-eveluated by the station. The station has an adequate number of whole body contamination monitors however, due to their design they are not fully effective at detecting contamination. The station had recently installed foot monitors at the exit to RCA on Unit 2&3 and 4&5. Personnel were confused about the necessity to use these monitors.

The station had begun to track the frequency of contamination alarms on the final RCA whole body contamination monitors (C2) at the beginning of 1999. Since this was started many contamination alarms were recorded for both January and February. This high rate of contamination monitor alarms is an indication that contamination is frequently present up to the final release point. The team recommended that the method of protective clothing removal and exit from the control area should be evaluated by the station to better control the potential spread of contamination at the final exit point.

EDF has established a corporate biological shielding programme which utilizes a standard approach for shielding installation. Standardization of equipment and material was observed to be evident to support standard procedures and training for contract shielding personnel. Additionally, this will support the future sharing of shielding equipment between stations.

Tools used in the RCA are issued inside the controlled area and are returned upon exit. The control of tools is the responsibility of the Fuel and Logistics Department and was well managed and the personnel demonstrated clear ownership for the programme. Tools are recorded in an interactive computerized database used for tool issuance which also contains administrative controls to make sure that any requirements, such as calibrations, are current before issuance.

All major areas of the RCA were posted with radiological information consisting of the dose rate, contamination level, and airborne levels if applicable. These are required by regulation to be surveyed and updated on a monthly basis. Additional postings of hot spots are provided to warn workers of higher than normal dose rates.

Materials being released from the RCA as clean are required to be less than 0.4Bq/cm² unless they are placed in a container for transport to another controlled area. This limit is not used for the release of personnel. The exit whole body contamination monitors are only required to ensure <8 Bq/cm² and re-evaluation of this inconsistency in release criteria was recommended by the team. A review of this standard was conducted by EDF corporate and the 8 Bq/cm² limit currently established as the standard was significantly higher than that used by many other nuclear stations.

The control of radioactive sources is consistent with good industry practice. While responsibilities for sources are divided between several organizations which utilize radioactive sources, there is adequate assessment and monitoring by the Measurement & Environmental Department.

Control of red areas (high radiation areas) was generally considered to be adequate. However, Bugey along with all other EDF stations has made a commitment to further strengthen the administrative controls for these areas.

6.3. INTERNAL RADIATION EXPOSURE

Whole body counting is established for measuring internal contamination of workers at Bugey. Personnel are given a whole body count when they first arrive at the station and when they leave the station. Whole body counts are also given once per six months or annually based on the classification of the worker. Additional whole body counting is performed if there is a suspected uptake. The whole body counting and assessment of the internal dose is performed by the Occupational Medicine Department which is well staffed and qualified to perform this function. The staff assists in the decontamination of personnel when the contamination involves significant levels of contamination. There were nine internal contaminations assessed by the department in 1998 all of which resulted in an estimated dose of less than 0.5 mSv/person.

Controls for protection of workers from internal exposure are established in the work planning process. While these controls have generally been effective, observed radiological work practices could result in potential internal uptakes. Industry experience has indicated that personnel involved with the changing of vacuum filters have a potential for being exposed to high levels of airborne contamination. The team suggested strengthening the controls for this type of activity at the station.

Tight control of contamination within the RCA is essential to reducing the potential for creating airborne radioactivity areas. The control of primary system leaks is essential for limiting this source of contamination. During plant tours, the team observed a number of radioactive system leaks (many of which were flange leaks) which in many cases had not been identified by the station, and none of which were contained or routed to a floor drain. This is an area where the team recommended additional attention by the station.

6.4. INSTRUMENTATION, EQUIPMENT AND FACILITIES

Control of RP instruments is managed by the Fuel and Logistics Department. Instruments are issued by the department at the normal tool rooms of the RCA. The calibration of all instruments including electronic dosimeters is performed by a contract organization. Instruments are routinely shipped to the contractor for required calibrations. Verification of calibration and source check of the instrument is performed at the time of issuance. Inventories are adequate to meet the stations needs, including outages, and the inventory database can be quickly searched to find additional instruments should the stock in a specific tool room run low.

Several area monitors used for determining the frequency for primary system filter changeouts were found to be out of calibration during plant tours. The station had decided in 1997 to remove these from service however, this had not been accomplished.

The instruments used by SRP personnel for performing routine statutory surveys and special surveys do not receive response and source pre-operational checks. The team recommended that all instruments receive pre-operational checks.

Inventory of equipment and protective clothing was adequate to support the stations needs and the facilities were adequate for storage, issuance and processing. The station performs its own laundering of protective clothing and the amount of available clothing and the processing capacity of the facility ensure an adequate supply. Self contained breathing apparatus (SCBAs) stored in the field appeared to be in good condition. These were contained in wall mounted units which were sealed to prevent tampering.

There are decontamination facilities at the personnel exits to the RCA and if decontamination is unsuccessful at these locations, the contaminated individual is transferred to the occupational medicine facility which has a very elaborate and well equipped decontamination facility.

6.5. PERSONNEL DOSIMETRY

In France, the employer is responsible for the statutory dosimetry of their employees. As such, contractors at the Bugey station bring their own film badges to the station. Bugey issues electronic dosimetry to all personnel working in the RCA to monitor their daily exposure. EDF employees are provided both film badges and electronic dosimeters at the station. Electronic dosimeters are calibrated annually by a contractor and dosimeters which appear to be damaged are also sent to the contractor for repair and calibration.

Bugey has developed a unique computerized method of dose tracking for the staff to use which is established on the stations local area computer network and computers have a special icon installed for easy access. This tool is very innovative and offers managers an effective tool for monitoring dose performance of workers within their departments. This tool also has an option for personnel to be able to access the latest survey data for various areas of the plant.

Internal doses are determined by the occupational medicine department and these evaluations also receive independent review. Records are kept for a period of 30 years. Calculated internal doses exceeding 0.50mSv are entered into individual dose records. This threshold is consistent with the threshold for film badge readings. The procedures for whole body counting are standardized for EDF plants and are consistent with standard industry practice.

6.6. RADIOACTIVE WASTE, STORAGE AND DISCHARGES

Goals for radwaste generation are included in the stations five year strategic plan, as well as specific actions for further reduction of generation. The station has taken a systematic approach to waste reduction and has greatly improved performance in this area over the past four years. The station will need to continue these aggressive efforts to become one of the better performing stations.

The General Services Department is responsible for management of the stations radioactive waste programme. This department is well organized and the programme is well managed. Waste processing, handling, packaging and shipping is well controlled.

Bugey has implemented the use of a unique type of equipment to weigh individual waste containers and to perform radiation surveys of the containers. This is used to provide a more thorough survey of the containers while lowering the dose to personnel responsible for this function. This system is also used to help characterize the waste container for shipment.

Waste segregation is considered a responsibility of the individual work supervisors. Based on the amount of waste observed in the plant, this has been generally effective. One exception is the amount of wood used in the RCA to support scaffold building. This is a significant potential source of radwaste and should be controlled to prevent any new wood from entering the RCA. Consideration should be given to systematically eliminating what is already present.

Goals for radioactive effluents are included in the stations five year strategic plan. The station has a well established effluent monitoring programme with upgrades of equipment from analog to digital currently underway. Sensitivity to maintaining good system reliability exists on the part of the Measurements and Environmental Monitoring Department (SME) staff.

The environmental monitoring programme has been established to meet regulatory requirements and is consistent with standard industry practice. An environmental laboratory is established in the vicinity of the plant and sample results are transmitted directly to the station.

6.7. RADIATION PROTECTION SUPPORT DURING EMERGENCIES

SRP personnel are on call to support emergencies at the station. Monitoring equipment is available for use on site as well as for areas adjacent to the station. Bugey has a dedicated emergency vehicle, containing materials and equipment, for immediate radiological support during emergencies.

The station also has a well equipped emergency response facility located directly onsite. The facility has an filtered emergency ventilation system, it is well shielded, and it contains the necessary materials and equipment to support onsite response and evaluation of protective actions. SME personnel are utilized in this facility to provide on-site and off-site assessment through the use of a computerized dose assessment model and through the use of a fixed radiation monitoring system located adjacent to the facility with detectors at distances of approximately one km and five kms.

Emergency dose limits have been established and potassium iodide is available for thyroid blocking for emergency workers. Potassium iodide was also provided to local residents within five kms of the station and was made available to residents living between five and ten kms from the station.

STATUS AT OSART FOLLOW-UP VISIT

At the conclusion of the OSART, one of the most significant areas of concern was in the area of radiological protection. The OSART resulted in six recommendations and one suggestion for improvement. Considerable emphasis has been made in the Radiological Protection Programme since the OSART, resulting in resolution of two of the recommendations and the one suggestion for improvement. Satisfactory progress has been made with regard to the other four recommendations as well.

Plant management has demonstrated a significant commitment to the programme and has taken actions to elevate its importance to the same level as nuclear safety through the formation of a Radiation Protection Review Committee equivalent to the Plant Safety Review Committee. A strategic plan has been developed which is comprised of the Radiological Cleanliness Project and the Health Project both of which include a significant number of initiatives designed to further strengthen radiological protection at Bugey. In addition, there have been additional resources added to the Industrial Safety and Radiation Protection Department which has played an important role in the implementation of the strategic plan.

Other significant improvements have been made in the control of contamination at the RCA entrances/exits and the monitoring of personnel at these locations. While progress has been made, there are still a considerable number of actions to be implemented and this will require continued management support to ensure their completion.

Another area of improvement is in contamination control within the RCA. Leaks are now identified and contained or routed to an appropriate collection system, which prevents the spread of contamination. While substantial progress has been made in this area, the ultimate fix needs to include elimination of the identified leaks. Currently there is insufficient progress in elimination of leaks and this condition will require additional management attention.

A concern with poor radworker practices had also been identified as an area for improvement and has since received some attention. The most effective way of ensuring a high level of performance by workers in the field is through effective coaching on a regular frequency by managers and supervisors. This routine reinforcement of management expectations is key to establishing and maintaining high levels of performance. While some progress has been made, achieving this higher level of performance will take a significant management presence in the field.

The specific concerns identified with the control of vacuum cleaners in the RCA and response checking of radiation survey equipment prior to use have been adequately resolved.

Overall, the Radiological Protection Programme at Bugey has improved significantly and further actions are planned to ensure continued improvement. Additional management attention will however be necessary on several of the items listed above to ensure their successful resolution.

DETAILED RADIATION PROTECTION FINDINGS

6.1. ORGANIZATION AND FUNCTIONS

6.1(1) Issue: Significant weaknesses in radiological protection programme exist due to lack of station-wide management emphasis along with insufficiently effective oversight and controls. Many aspects of the radiological protection programme have been divided among multiple departments, and while there are examples of good performance, significant weaknesses were observed across many departments activities.

The responsibility for individual radiological protection rests primarily with the workers providing their own self-coverage. This approach can work well provided there is a high regard from RP among the staff and supervisors and an organization providing strong oversight evaluation of overall performance. However, activities performed by many station organizations inside the radiologically controlled area (RCA) did not demonstrate a high respect for minimizing, monitoring and controlling contamination.

The following are examples of ineffective overview of the RP programme implementation:

- Actions by the staff of various station departments do not serve to minimize and control contamination to prevent spreading [see issue 6.3(1)].

- Inappropriate radiological worker practices were frequently observed and sometimes accepted by radiological protection staff and supervisors during extensive tours in the RCA [see issue 6.2(3)].

- Practices by many staff in exiting the RCA do not minimize the risk of contamination leaving the RCA [see issues 6.2(1) and 6.2(2)].

- Contractor personnel, responsible for laundering and monitoring of protective clothing for reuse, failed to adequately follow procedures such that contaminated clothing was placed back in the RCA for reuse.

- Items which had been monitored for release and determined to be clean were found to be contaminated when surveyed at the final release building. Additionally, since new controls were established for the release of materials from the RCA, many problems have still been identified. Approximately 50 non-conformances have been identified and reported since these additional controls were implemented. Copies of these non-conformances have been forwarded to SRP however, they have not yet been reviewed for possible trends.

- Inadequate monitoring and control of items entering the RCA contributes to unnecessary radwaste generation through materials becoming unnecessarily contaminated. Significant amounts of wood have been allowed to enter the

RCA, primarily for scaffold building. This wood contributes to the overall radwaste generation for the station.

Recommendation: Management should place additional emphasis on improving the radiological protection programme at the station and should ensure that strong station-wide management methods of oversight and control are established.

Plant response (response given by: L. METTON)

Within the context of project management mode, senior plant management has initiated a radiation protection project consisting of a radiation protection – health branch and a radiological cleanliness branch. This project is included in the plant strategic plan.

The main objective is to deal generally with the problem and to bring radiation protection up to the same level as nuclear safety within three years.

This project was implemented in several stages:

- In May 1999: initiation of the radiological cleanliness project consisting of 14 lots (document ref.: D5110/NS/99008): communication, methods and measurements, penetration of barriers, design of RCA exits, cleanliness of the decommissioning of Bugey 1, alpha radiation, basements and water table, Bugey 1 graphite sleeve repository, fuel, waste, tools, transport of tools, field operations and leaks and work sites in the RCA.
- In October 1999: initiation of the radiation protection – health project consisting of 7 lots (document ref.: D5110/NS/99011): management, methods and measurements, self-protection, regulations and statistics, communication, training and health aspects.
- In January 2000: the two projects were united (document ref.: D5110/NS/00001), with the same project co-ordinator and the same project manager.

- In October 1999: setting up of the radiation protection cleanliness review committee (document D5110/NT/99052). This committee is composed of 14 people from the line management departments, including a works doctor who is the co-ordinator and it monitors the progress being made with the project and gives an opinion on the solutions proposed by the lot managers. It is convened every 2 months (16 September 1999, 18 November 1999, 20 January 2000, 16 March 2000).

- In December 1999: setting up of the radiation protection review committee (known by the French abbreviation GTR) (document ref.: D5110/NO/99002). This body is the equivalent of the plant safety review committee (GTS) and it is informed of the project progress. It decides on the main solutions to be adopted in the areas of radiation protection and radiological cleanliness. This handles the problems encountered in radiation protection and radiological cleanliness in the same way as nuclear safety related problems. The GTR is composed of the members of the plant senior management team and a works doctor, a total of 10 people. It meets every 3 months and upon request or in the event of urgent problems. The first meeting took place on 10 December 1999 and the second on 28 March 2000.

Composition of the project group:

– Project co-ordinator (Bugey Generation Group Manager), he is also in charge of problems related to the environment and monitors the progress of the project and is the representative of the Plant Manager.

– Project manager (attached to the Senior Plant Management, post created on 1 January 2000), has been in charge of the field of radiological cleanliness since the beginning of 1999.

– Deputy Project Manager (Head of the Industrial Safety Radiation Protection Department), in charge of the field of radiation protection – health.

– Lot managers, work co-ordinators (19 people from the line management departments), in charge of a lot and chosen for their competence in the field dealt with.

– Radiation protection cleanliness review committee.

– Radiation protection review committee (GTR).

In addition, an audit manager from the Nuclear Safety QA Team is especially in charge of the areas of radiation protection and radiological cleanliness and carries out the audits in this field.

IAEA comments: There has been a significant commitment made by management to the radiological protection programme at Bugey since the OSART mission. The most significant of which is the establishment of a Radiation Protection Review Committee similar to the Plant Safety Review Committee, which has raised radiological safety in line with that of nuclear safety. A detailed strategic plan has been developed which is comprised of a radiological cleanliness project and a health project with a number of specific focused areas for improvement. The individual focus areas within these two projects are assigned a responsible manager to ensure successful implementation of the initiatives for their focus area. Additional oversight is provided by a Radiation Protection Cleanliness Review Committee. There has also been a restructuring of the Industrial Safety and Radiological Protection Department, which has included an increased responsibility, a significant increase in the number of staff, and improvement in the level of competency. This restructuring and increase in staffing has played an important role in the implementation of the strategic plan. These key actions demonstrate management's heightened commitment to the programme.

Conclusion: Issue resolved

6.2. RADIATION WORK CONTROL

6.2(1) Issue: The physical layout and practices at the radiological control area (RCA) entrance/exit do not minimize the potential for the spread of contamination or the potential for contaminated people reaching the final monitors. The same area, without physical separation, is used to put on protective clothing when entering the RCA and to remove the clothing when exiting the RCA. In addition, potentially contaminated clothing is frequently reused for subsequent visits to the RCA. The plant relies on the final portal monitor to determine if contamination exists. Good international practice requires that every effort is made to ensure that individuals are free of contamination before the check at the final portal monitor.

There is a foot monitor located prior to the first whole body contamination monitor (C1). However it is frequently not used and expectations for its use are not clear. The first whole body monitor (C1) is set at a relatively high value of 150 Bq/cm^2 and does not directly monitor shoe contamination. Personnel must pass through the C1 monitor to reach the undressing area. Once in the undressing area, the potentially contaminated clothing and shoes are removed in a random manner with no controlled undressing sequence to limit the spread of potential contamination. Personnel then proceed from this area without passing any intermediate step (i.e., over a barrier) to limit the potential for contamination reaching the final whole body contamination monitors (C2). They then enter the C2 monitor, which is set to ensure $< 8\,Bq/cm^2$. There have been an average of 75 significant decontaminations necessary each year as a result of personnel alarming the final C2 monitor. An average of >350 alarms/month on the C2 monitors have occurred during the first two months of 1999. This is a high frequency rate when compared to other stations. The frequency of these monitor alarms was not evaluated prior to 1999.

In addition, some workers who frequently visit the RCA remove their potentially contaminated radiation clothing and store it for reuse.

While the final portal monitor is there to ensure that no contamination exits outside the RCA above the allowed levels, undressing and monitoring practices could result in unnecessary spread of contamination in the RCA. It should not be relied on to detect known contamination, which can exist right up to the final whole body monitor (C2). The practice of reusing clothing, which may be potentially contaminated, inside the RCA could result in the spread of contamination and increase the personnel risk of skin contamination.

Recommendation: The plant should re-evaluate the undressing and monitoring procedures in the zone located immediately before the exit from the RCA. More disciplined undressing procedures, the use of step over barrier before reaching the final monitor, physical separation between people entering and exiting the RCA and the reuse of potentially contaminated clothing should be part of this re-evaluation.

Plant response (response given by: L. METTON)

This recommendation has been taken into consideration by lot 1, "control of the penetration of barriers", of the radiological cleanliness project.

A complete reorganisation of the EDF and the contractors' hot change rooms in the main RCA of units 2/3 and 4/5 was undertaken in May 1999 in order to:

- Stop the distribution of socks from the RCA to the cold change room (replaced by PVC overshoes).
- Physically separate the ways taken by the employees going into and coming out of the RCA.
- Mark off the sub-areas for dressing out and undressing and access to the C2 control portal.
- Define an order for getting undressed.
- Clearly display the procedures for radiation protection control and undressing.

- All of these new arrangements have been in use since the beginning of 1999.

- The change room guard gives advice to the users, makes sure the good practices are adhered to and records any non-compliance (triggering of an alarm on C1, C2 portals, etc.).
- Three sub-areas have been created and area dividers have been arranged so as to guide the users:
  - in the direction for dressing, slipper area, sock area and shoe area,
  - in the direction for undressing, shoe area, sock area and slipper area.
- The hygiene requirements (washing hands and forearms) are indicated.
- Suitable signs are displayed explaining all the actions and proper practices to be carried out:
  - controls upstream of the C1 monitoring portals, at the C1 monitoring portals, at the C2 monitoring portals, at the MIP21 frisker and at the small articles checker,
  - definition of the order for getting undressed,
  - use of sticky mats.

This method limits the spread of contamination from the change rooms. Since these new arrangements were implemented, there has been a sharp decrease in the number of alarms triggered in the C2 portals (number of alarms per number of people going through = 6.84% in June 1999, 4.12% in September 1999, 2.84% in November 1999, 1.45% in January 2000, 1.46% in February 2000).

Furthermore, information sessions were carried out within the line management departments (valve work department 31 January 2000 and 8 March 2000, work co-ordinators for the outage on unit 3 on 16 February 2000, for the other maintenance, RP and support departments (SLA, SRP, SCL, SGS and STN departments and contractors before the outage on unit 3, etc.), by the radiological cleanliness project manager to present the new procedures and give a reminder of the proper practices:

- to prevent contamination from being spread from the employees (clothing contamination): this involves proper practices concerning hygiene;
- to prevent the spread of contamination outside the work sites.

In addition, the site has embarked on a study of the general restructuring of the change rooms for access to the main RCA of units 2/3 and 4/5. This is considering the grouping together of the contractor and EDF change rooms with an enlargement of the women's change rooms, increase in the number of showers

The modification of the other change rooms for access to the RCA is currently being studied. The implementation of a new organisation has been delayed by numerous lay out problems related to civil engineering.

IAEA comments:

Newly implemented changes in the layout of the RCA entrances/exits have had a substantial impact in reducing the number of alarms received at the final C2 contamination monitors. The process is still being refined and a test is now being performed to determine if the laundering capability of the facility is capable of keeping up with the demand for protective clothing so that the practice of reusing contaminated protective clothing can be eliminated. The success of this test is important to the continued improvement of this contamination control effort and the plant is strongly encouraged to find a permanent method of eliminating reuse of contaminated protective clothing. The two potential long-term initiatives being considered for improving access are the upgrade of the existing contractor entrances/exits as common accesses, and potentially constructing a new single RCA entrance/exit. Implementation of a long-term solution to the RCA access point will be necessary for Bugey to solve the identified contamination control concerns.

Conclusion: Satisfactory progress to date.

6.2(2) Issue: Some aspects of monitoring personnel and equipment upon exiting the RCAs are not fully consistent with good industry practices to detect and control contamination. Inconsistent standards exist for the monitoring and release of materials, equipment and personnel from the RCA. Items are sometimes removed from the RCA without being checked for contamination.

– A special monitor (CPO) is installed at the exit of the main RCAs for individuals to check their badge, dosimetry, and hand held items for contamination prior to release from the RCA. However, this equipment is sometimes not used by workers, supervisors, and radiological protection staff. Some people who frequented the RCA were not knowledgeable in the use of the equipment.

– A cart for transporting protective clothing was taken into and out of the RCA from the turbine building several times without monitoring for the spread of contamination.

A foot monitor located at the exit of the RCA is frequently not used by personnel prior to entering the clothing change area. Workers, radiological protection staff, and trainers expressed different expectations for the use of the foot monitors.

There are two standards for the release of materials/equipment and personnel from the RCA. The limit for final release of material/equipment from the site is <0.4 Bq/cm^2. This is currently the value which is considered clean by the station. However, personnel exiting the RCA are only monitored to ensure they are $<8 Bq/cm^2$.

Contamination frequently makes it to the final whole body exit monitors (C2) as evidenced by the >350 alarms/month received during the first two months of 1999.

Two of the 13 C2 monitors at the exit of the RCA were response tested at the request of the team. One of the two monitors was found to have inadequate response time and was taken out of service.

The station is currently investigating the improper monitoring of laundered protective clothing which allowed protective clothing to be returned for use in the RCA with contamination well in excess of the established monitoring limits.

Failure to perform surveys of all materials leaving the RCA and applying conservative release limits to all items released from the RCA could result in the spread of contamination to areas outside the controlled area.

Recommendation: The current practices, controls, and training should be upgraded to ensure that all personnel and materials are monitored for contamination prior to exiting the RCAs. Improvements should be made in the methods for monitoring and consistently conservative limits should be established for release of materials and personnel.

Plant response (response given by: L. METTON)

The practices implemented for the exit of equipment and personnel from the RCA are explained in the organisation document "organisation for the exiting of equipment and personnel from the RCA" reference D5110/NO/99001 distributed in December 1999.

This document defines the acceptable levels of smearable contamination for equipment and their transit rooms as well as the radiation protection monitoring requirements (first check by the work supervisor and second check by an independent employee who authorises the exit of the equipment from the RCA). It also deals with the principles of containerisation of all the equipment and periodical radiological monitoring of routes.

Concerning the exit of personnel, the document specifies the adjustment threshold for the C0 (laundry), C1, C2 monitoring portals and the small article checkers (RCA change rooms), the rules for sorting and transporting laundry from the RCA, the method for treating clothing contamination and the periodic radiological monitoring of floors and in the change room lockers.

All the arrangements in this organisation document have been in force since the beginning of the year 2000.

Study sheets were written to describe the exiting procedures for clean equipment and radioactive equipment and widely distributed to the various participants. A temporary procedure was written for the exit of small personal articles and so-called "transnuclear" tools.

- The change room guard (exiting of personnel) and the employee carrying out the second check (exiting of equipment) give advice to the users, make sure that the proper practices are adhered to, and record any non-compliance (triggering of alarms on the monitoring portals, contaminated equipment, non-compliance with procedures, etc.).
- Periodic monitoring of the transport routes has been carried out since September 1999 within the framework of a service contract for the exiting of any equipment, which cannot be put in a container.
- Information sessions were held between January and March 2000 in the line management departments (valve work, operations, rotating machinery, fuel, general services, modifications, radiation protection, work co-ordinators and contractors for the unit 3 outage) by the radiological cleanliness project manager to present these arrangements and a reminder of the proper practices:
  - to prevent the employees from spreading contamination,
  - to trap the contamination as close as possible to the work site,
  - to prevent the contamination from being spread outside the RCA.
- Complementary radiation protection training of 2.5 days per employee concentrating on the radiation protection measurement techniques was carried out for all the personnel in the Radiation Protection Department between September 1999 and March 2000.
- A working group (Training Manager, Deputy Head of the Radiation Protection Department, Deputy Generation Group Manager and representatives of the line management departments) was set up in charge of adapting the contents of radiation

protection refresher training to the new requirements in December 1999. The new programme will be implemented for the 2000/2001 cycle of refresher training.

In addition, work site training facilities set up in unit 1 and used for radiation protection refresher training will be accessible as from May 2000. The purpose of these facilities is to enable employees to regain the proper radiation protection practices, to familiarise themselves with the monitoring devices and to see again how to take measurements of dose rates and contamination.

Concerning the consistency of the thresholds for the exiting of the personnel and equipment, actions aimed at lowering the background noise and consequently the thresholds for triggering the alarms were undertaken for the C2 monitoring portals.

- In July 1999, the number of lockers in the hot change rooms were reduced and put further away from the C2.
- In December 1999, removal of socks from the RCA between the hot change rooms and the cold change rooms, decrease in the quantity of coveralls and place for their storage, setting up of a clean area around the C2 and improved flow separation of people coming in and going out.

These arrangements have lowered the average level of background noise by 10%. The alarm previously adjusted at 800 Bq from a source of Co60 of 100 cm^2, was lowered to 330 Bq over 100 cm^2 i.e. measured by a meter over 600 cm^2, an activity of 3.3 Bq/cm^2 or on average 0.55 Bq/cm^2 integrated over the total surface of the monitor.

- In February 2000, the calculations of the minimum detection limit compared to the average background noise and the alarm threshold mentioned above enabled the consistency between these values to be checked. They allow for an acceptable number of inadvertent alarms, a high rate of reliability and a detection probability approaching 97.5% for the right contractual monitoring time.

In addition, the replacement of the current C2 monitoring portals with more effective models is planned at French NPP corporate level and especially at Bugey, as from the year 2001. Performance testing of the two prototypes was carried out on units 5 and 3 of Bugey NPP in September 1999.

Finally, the site has embarked on a campaign of replacing the standard cotton suits with suits made of synthetic fibre. The purpose is to have a product which attaches the contamination less during washing. The final tests were carried out in January 2000 and a first batch of 2,000 suits will be delivered in April 2000.

IAEA comments:

Progress made to date with lowering the C2 monitor alarm threshold demonstrates the commitment to improving monitoring of personnel exiting the RCA. The alarm setpoints have been reduced from 800 Bq over 100 cm^2 to 330 Bq over 100 cm^2. While this is still inconsistent with the limits for release of equipment, it is substantially better than the previously established setpoints. Further reduction in alarm settings is currently not possible due to equipment limitations and radiation background levels. The initiative to upgrade the exit monitors is currently being pursued through EDF corporate and it is projected that some of the new replacement monitors would be acquired and installed by the middle of 2001 pending decisions by corporate. Based on discussions with the RP staff, it was clear that the overall objective was to have a single release threshold for both personnel and equipment. As an additional barrier to ensure that no radioactive material inadvertently leaves the Bugey Plant, an additional set of monitors (C3) are planned for installation at the plant exits by the end of 2000. These monitoring improvements coupled with already implemented procedural and training enhancements will ensure resolution of the original issue.

Conclusion: Satisfactory progress to date.

6.2(3) Issue: Inappropriate radiological worker practices by station and contractor personnel were frequently observed and sometimes accepted by the workers supervisors and radiological protection staff and supervisors during extensive tours in the RCA. Some of the most significant were as follows:

- Workers and radiological protection staff did not always wear the protective clothing as required. Some personnel remove the cotton gloves to perform work within the RCA. Workers were observed with protective clothing sleeves rolled up. People were observed handling wet contaminated items wearing only cotton protective clothing. Workers and supervisors entered and exited posted contaminated areas without wearing the required protective shoe covers.

- Personnel were observed performing inadequate contamination monitoring of tools being returned to the tool room. In some cases they waved the item quickly in front of the detector and in other cases the items were not placed in front of the detector.

- Inconsistencies were observed in wearing supplementary protective clothing. During work on the Unit 3 fuel pool cooling pumps workers were observed wearing air supplied hoods, rubber gloves, and additional plastic clothing to perform their work, while other workers were allowed to come very near the work area and one individual (dressed in standard protective clothing) actually went up to the work area to provide the workers with tools.

- Station staff including an RP technician were observed exiting the RCA without checking hand held items with the CPO contamination monitor. Additional observations indicated that this happens routinely.

- While observing preparation work for performing a hydraulic test in room N301 many poor radworker practices were observed. These include inadequate control of the contaminated area boundary, inconsistent and improper use of air line respirators, and failure to utilize the available radiation survey meter.

- The doors to the hallway containing the valves to the deminerilizers and filters were found open even though they were clearly marked to be closed to prevent the spread of contamination.

Inadequate adherence to radiation protection rules and procedures can lead to increased radiation exposure and the spread of contamination.

Recommendation: Management should ensure proper radiological worker practices are widely understood and enforce the existing rules and procedures.

Plant response (response given by: L. METTON)

The 7 lots (management, methods and measurements, self-protection, regulations, communication, training and health aspects) of the radiation protection – health branch of the radiation project respond to this concern about adherence to the proper practices and their comprehension. The lot concerning work sites in the RCA in the radiological cleanliness branch also contributes to this not only through the redefinition and the reapplication of the fundamentals (individual and collective protective devices, containment, warning signs and measurements on the work sites) but also through the setting up of work site training facilities in the rooms of Bugey 1.

Furthermore, in order to improve the quality of work site and plant tours, a training module on observation and inspection techniques (management industrial safety walkabouts) was set up in September 1999. This is aimed at technical supervisors and first-line managers (180 people). The training lasts 3 days per person and started in December 1999. The application of the inspections by the people already trained was effective as from January 2000. 23 inspections were carried out between 1 January and 15 March 2000.

A reminder of the roles and responsibilities of managers was also presented during the meetings between the radiation protection cleanliness project manager and the participants.

In May 1999, a study of the competencies and role of the Industrial Safety and Radiation Protection Department was undertaken in order to make improvements to the department. This led to the recruitment of 3 engineers and 5 senior technicians in radiation protection. As from January 2000, the department consists of 55 members and is organised into 5 sections (health, engineering, methods, radiation exposure/statistics and operational aspects). It mainly acts in a capacity of providing support, advice and expert evaluation to the line management departments. In addition, the engineering and operational sections are entrusted with the task of audit/random checking of the application of the radiation protection rules and procedures. Any non-compliance is tracked via deviation sheets.

IAEA comments:

The training of line managers and first line supervisors in observation and inspection techniques has been implemented. A large number of these individuals have completed the training and have begun conducting work area tours. Some problems are being identified during these field observations and a subset of these are being corrected on the spot. Observations by the Team indicated the radworker performance had improved since the time of the OSART. Enhancements to radiological protection training and upgrading of specific worker competencies will be very important in resolving poor radiological work practices. However, the most effective way of ensuring continued high level performance by workers in the field is through effective coaching on a regular frequency by line managers and supervisors. This routine reinforcement of management expectations is key to sustained high levels of performance. While some progress has been made, achieving this higher level of performance will take a significant management presence in the field, providing the right standard on a consistent basis. Additionally, deviations found in worker performance will need to be documented and evaluated for potential trends. Further implementation of the management observation and inspection program, with continuously improving expectations for performance, will ensure that radworker performance is maintained at a high level.

Conclusion: Satisfactory progress to date.

6.2.(4) Issue: The station had not implemented a programme for the control of vacuum cleaners inside the RCA. Several vacuum cleaners were observed being used in the RCA that did not have controls to prevent inadvertent opening. Others were observed stored or staged for use in the RCA.

Radioactive materials can become concentrated in vacuum cleaners and result in airborne radioactive releases when opened and elevated radiation levels when in use. One vacuum cleaner that was being used along with a wet scrubber to clean hallways in the RCA was found to have dose rates on contact as high as 1 mSv/hr.

Industry events related to untrained personnel opening vacuum cleaners have occurred on multiple occasions.

Suggestion: The station should consider establishing tighter controls along with physical barriers such as locking devices to prevent unauthorized or inadvertent opening of vacuum cleaners.

Plant response (response given by: L. METTON)

All vacuum cleaners used within the radiologically controlled area have been fitted with a padlocking device preventing unauthorised or non-intentional use of the equipment. This modification was carried out during February and March 2000 under the auspices of the site civil works department, in charge of this equipment. Unlocking and opening of vacuum cleaners is carried out in clearly defined areas under the responsibility of an authorised worker.

In addition, an equivalent γ dose rate measurement is carried out both when the vacuum cleaner is taken from and returned to its storage area. The values measured are tracked on a monitoring sheet provided for each vacuum cleaner.

IAEA comments:

The methods established for the control of vacuum cleaners in the RCA is considered to be effective and is in line with standard industry practice. Requirements are in place for locking of vacuums to prevent inadvertent opening by workers unaware of the potential radiological hazard. Additionally, vacuums are surveyed when issued, while in use, and when returned to prevent the creation of high dose rates coming from the filter housings. The implementation of these controls was observed to be effective.

Conclusion: Issue resolved

6.3. INTERNAL RADIATION EXPOSURE

6.3.(1) Issue: The station does not have an effective programme to control contamination at the source and minimize its movement to clean areas. Leaks were frequently observed inside the nuclear auxiliary buildings of Units 2&3 and Units 4&5 that were not contained to prevent the spread of contamination.

In some areas, puddles of water were observed around equipment and on the floor that were not contained or clearly marked to warn personnel. There was also no indication as to whether they were contaminated. When station staff were questioned, most people did not know if the areas were contaminated. They also took no action to report the problem.

In some cases, water was dripping from areas above and was not collected or contained. Many of these leaks were specifically related to leaking flanges on radioactive systems. The leakage was most times not identified and reported for corrective action. Contributing to this, identification and reporting of leaks is viewed by many as being the responsibility of operations department. It is also not part of the radiological protection routine monitoring programme.

Recommendation: Actions to eliminate and contain contamination at the source should be strengthened. All leakage inside the RCA should be identified, contained to prevent spread of contamination and reported for corrective action.

Plant response (response given by: L. METTON)

The study of a simple and effective organisation for the detection, collection and stopping of leaks as quickly as possible was embarked upon in September 1999. This was initiated by the radiation protection project group and co-ordinated by the operations department. The following organisation principle was thus adopted:

- Any worker discovering a leak should inform the operations department indicating the size and location of this leak.
- The operations department then:
  - identifies the origin and the risks associated with the leak (chemical, radioactive, pressure/temperature, spread to sensitive equipment, etc.),
  - if possible isolates the leak,
  - puts up warning signs in the area at risk,
  - as much as possible collects the leak (recovery in a specific recipient, channelling towards collector, etc.),
  - places an identification label as close as possible to the leak. This label describes the type of leak and indicates that corrective actions are underway,
  - makes the work requests required for cleaning and stopping the leak and defines the priority for treatment. Each work request is subject to joint analysis by the operations department and the owner of the defective equipment and bears a specific identification ("EF type" effluent) so that the total number of leaks and the progress of the corrective actions can be known at any moment.

– The department owning the equipment is in charge of repairing the equipment.
– The general services department is in charge of cleaning the polluted area.

All the arrangements mentioned above are detailed in the document D4110/NS/00002 "Leak management " written in February 2000.

IAEA comments:

Efforts by the plant to identify system leaks have been implemented. These efforts are in their early stages of implementation and are still being improved upon. Currently the number one priority has be the identification of leaks and collection of these leaks or routing the leakage to the applicable collection system. Tours of the RCA indicate that leaks are being identified by labelling and in most cases properly contained. Success in controlling contamination within the RCA is reliant on successful containment of these leaks and more importantly the elimination of the leaks altogether. It is evident that the Operations department is identifying and labelling existing leaks. In most cases leaks are properly contained or routed for collection. It is also evident that the leaks are being placed in the work management system for ultimate repair. Since progress has been made in the identification and containment of leaks, it is evident that contamination control has also improved. Because of this improvement, satisfactory progress has been made on this issue. However, ultimate success of the contamination control program is elimination of the contamination at its source. This cannot be completely effective as long as system leaks are allowed to exist. The goal of the leak identification program needs to be focused on elimination of identified leaks as rapidly as possible. Based on the original identification dates of the leaks observed in the plant, it was common for leaks to exist for periods greater than six months. Continued progress in this area is reliant on quick response to correcting these system leaks. (Reference Maintenance Issue 4.6(1) for additional discussion concerning material condition and elimination of system leaks)

Conclusion: Satisfactory progress to date.

6.4. INSTRUMENTATION, EQUIPMENT AND FACILITIES

6.4(1) Issue: Survey instruments utilized by RP personnel for statutory radiological surveillances are not checked prior to use by performing a response check or source check. This is inconsistent with standard industry guidance for pre-operational checks of survey meters.

The practice used by RP personnel is inconsistent with the standard practice used by Fuel and Logistics personnel for instruments issued to workers from the tool rooms in the RCA. A source check is performed on these instruments prior to issuance.

Specialized survey instruments such as those used for performing alpha and neutron surveys are also not response or source checked. Given the infrequent use of these instruments and the typically more significant hazards associated with these types of radiation, it is important to ensure their proper operation prior to use.

Recommendation: A mechanism to response check and/or source check all instruments used for performing radiological surveys should be implemented that is consistent with industry practice.

Plant response (response given by: L. METTON)

Regarding the checking with a source of radiological measuring instruments issued by the tool stores, the following equipment is now installed at each distribution point (unit 2/3 storeroom, unit 4/5 storeroom, north service point and waste treatment & auxiliary building (BANG)):

- 1 gamma irradiation unit (Co60) for the checking of dose-rate meters. A sign placed nearby indicates the references and activity of the source as well as the values expected for each type of dose-rate meter.
- 1 box containing a β (1000 Bq Co60) and α (100 Bq Am 241) source support, destined for the checking of contamination measuring probes and a sign with the references and activity of each source as well as the expected values for each type of probe.

These means of checking are under the responsibility of the stores personnel in charge of checking and managing tools and are accessible to the users.

Concerning the checking of radiological measuring instruments used by the Radiation Protection Department personnel, the following equipment is installed in the department measuring device storeroom:

- 1 gamma irradiation unit (Co60) for the checking of dose-rate meters. A sign is placed nearby indicating the references and activity of the source as well as the values expected for each type of dose-rate meter.
- 1 box containing a β (1000 Bq Co60) and α (100 Bq Am 241) source support, destined for the checking of contamination measuring probes and a sign with the references and activity of each source as well as the values expected for each type of probe.

Specific point related to neutron measuring devices:

Considering the specific nature of neutron measurement and the infrequent use of the corresponding measuring instruments, there is no arrangement for checking with source at the distribution points. However, a monthly check with a source (Am-Be) of each measuring device is carried out under the responsibility of the Radiation Protection Department. A reference device of each type, calibrated by an approved off-site laboratory through comparison of results checks the indication on the instrument checked. The results of these checks are filed.

The updating of the activity of each source and consequently of the expected values is the responsibility of the Radiation Protection Department.

IAEA comments:

The plant has taken specific actions to establish procedures and to provide the necessary sources for performing response checks on instruments issued to plant workers as well as those used by radiation protection personnel. Specific criteria have been established to ensure that these instruments are responding properly prior to use. These actions have been successfully implemented and were observed in use in the plant.

Conclusion: Issue resolved

7. CHEMISTRY

7.1. ORGANIZATION AND FUNCTIONS

The Chemistry Section forms part of the Measurement and Environment Department (Service Measurement and Environment, SME). There is a single chemistry section on site responsible for the primary and secondary chemistry of all four PWR units, operation of the demineralized water production plant, control of radioactive effluent treatment systems and environmental surveillance. The section performs both routine chemical and radiochemical monitoring of the various fluid systems, plus any special/non-routine analysis requests that may arise. Cooperation between chemistry and other site departments was good, with a particularly strong relationship between operations and chemistry. This is reinforced by various meetings between the two organizations, particularly at the weekly meeting on Fridays attended by several important role players from within each area.

Relationships between site chemistry and corporate organisations are good, particularly those with the Corporate Chemical and Metallurgical Laboratories (Groupe des Laboratoires, GDL) and the Safety Radiation Protection and Environment Department (Department Sûreté Radioprotection Environment, DSRE). GDL assign a liaison engineer to the site, who acts as an information conduit for experience feedback on national and international problems and developments.

Resources are sufficient to support the operation during normal and outage periods. Chemistry staff do not normally work shifts, cover being provided by a standby system, but provide full 24 hour on-site coverage during the critical periods of startup and shutdown operations. Responsibilities and accountabilities for each of the teams within chemistry are clearly defined and communicated into the organization.

Goals and objectives are developed in accordance with the site strategic plan. The chemistry section is committed to a contract with the plant manager. This contract includes all of the objectives for chemistry. The goal and objective setting process does not have a long history and little use is made of measurable targets to drive improvement. Large numbers of objectives are identified (91 in 1998, and 45 for 1999) for the department, which would be difficult to manage if hard targets were set for each one. A good aspect of this process is that each objective is assigned to a named individual within the chemistry management team, who then assumes complete responsibility for attainment of the objective. These then form the basis of their individual contracts with the SME manager. The subjectivity of the annual assessment process could be improved by assigning more measurable targets to these objectives.

Chemistry maintains a number of performance indicators to help them gauge the success of their chemistry programme. Measurable targets are defined only for effluent release radioactivities and volumes. Improvement drivers for the other indicators thus tend to be reactive rather than proactive. Setting measurable targets for goals in these other performance indicators could assist in attaining improvements.

A comprehensive training programme has been developed for chemistry personnel, comprising theoretical knowledge transfer and on-the-job-training. The latter is mainly shadow training. The theoretical programme has been broken down into several areas that mirror the actual work team areas within chemistry, plus some general areas that apply to all employees. The information provided through these formal training programmes provides a solid understanding of the tasks and functions performed by chemistry and their impact on plant operations. During the evaluation, staff demonstrated a reasonable knowledge and understanding of systems chemistry as well as current analytical techniques and procedures.

Shadow training is much less structured and the training goals have not been defined. The team recommended that the shadow training programme be formalised with specific targets included. This recommendation is incorporated within the general recommendation on job specific refresher training described within the Training Section of this report. Identification of refresher training needs could in part be determined from statistical evaluation of technician/analyst performance in the measurement of analytical control standards.

7.2. CHEMISTRY CONTROL IN PLANT SYSTEMS

The primary chemistry control regime on all four units is based on maintaining the at-temperature pH at a value of 7.2 for as long as possible throughout the operating cycle, while respecting a maximum lithium value of 2.2 mg/kg. This means that the pH at the start of the cycle is about 6.9 and increases as the cycle progresses, by holding lithium constant and reducing boric acid concentration, until the 7.2 target value is reached. Thereafter lithium is coordinated to boron to hold the pH constant. The ability to maintain a constant pH is hampered by the frequent load following imposed on the units. Because of the lack of grey rods, load following operations require dilutions and borations of the reactor coolant that dilute the lithium concentration, causing frequent lithium excursions. In order to minimise these excursions during periods when chemistry expertise is not on-site, the plant has introduced an innovative solution by adding lithium to both the degassed, demineralised primary make-up water tanks (REA-eau) and the boron make-up tanks (REA-bore). Thus, whenever there is a programmed water movement into the reactor coolant, a certain amount of lithium is added. The frequency of lithium measurement has also been increased from the three times per week specified by the GDL to once per day. These steps have significantly reduced both the magnitude and frequency of lithium excursions.

The primary systems resin management programme has reduced the frequency of change-out of resins. On-line lithium conditioning of cation resin has eliminated the need to purchase expensive lithium-7 form resin. This has led to both a significant reduction in solid radioactive waste production and cost savings and was considered by the team to be a good practice.

Three different secondary chemistry programmes based on morpholine all volatile treatment (AVT) are applied. Units 2 and 3 apply morpholine AVT with an elevated feedwater pH (9.2 to 9.3) and boric acid treatment (BAT). Unit 4 applies morpholine AVT at lower feedwater pH (8.7 to 9.0) and BAT. Lastly, Unit 5 applies only morpholine AVT at feedwater pH 9.2 to 9.3. These different chemistries take into account materials differences in the units. Units 2, 3 and 5 have replaced the original condenser tube bundles and now have stainless steel tubes, hence they run at an elevated pH to minimise flow-accelerated corrosion. Unit 4 has the original brass tubed condenser and must limit the feedwater pH. Units 2, 3 and 4 have the original 51A type steam generators with mill annealed inconel-600 tubing and drilled circular hole carbon steel tube support plates. These units have extensive secondary side intergranular attack (IGA) and intergranular stress corrosion cracking (IGSCC), hence the use of BAT. Unit 5 has replacement type 51B steam generators with inconel-600 thermally treated tubes and broached quadrofoil 13 percent chrome ferritic steel support plates, hence BAT is not used on this unit.

The plant has developed an innovative method for monitoring primary to secondary leak rates using lithium. This supplements nitrogen-16 and tritium monitoring and, under certain circumstances, can be used for leak measurement where nitrogen-16 fails. The team considered this a good practice.

7.3. CHEMICAL SURVEILLANCE PROGRAMME

The specifications used are based on the general EDF chemistry specifications given in the handbook “Spécifications Chimiques et Radiochimiques Centrales REP” jointly issued by GDL and DSRE. The plant has adapted this document to its own specific needs and has supplemented the requirements with more rigorous requirements of its own. A defence-in-depth system has been implemented to ensure surveillance frequencies as laid down in these documents are respected, with checks being performed at several levels in the system.

The quality of the analyses meets the requirements laid down by GDL and the site. The chemistry section have made a major effort over the last four years to put an effective quality assurance / quality control (QA/QC) programme in place. This has been successfully implemented but the team identified some weaknesses in the programme and recommended that some areas be improved.

Several years ago GDL instituted a laboratory inter-comparison programme for chemical measurements. However, since 1995 only three samples, covering only some six parameters, have ever been delivered to the site. Laboratory inter-comparisons are a very good means of tracking a laboratory’s performance capability measured against its peers. However, for such a programme to be effective and of benefit to the power plant, a much more intensive programme is needed.

The on-line analyser programme is effective, with a high availability of the equipment. Adequate equipment is available to continuously monitor the plant chemistry control programme under various operating conditions, though principally normal operation. The analyser measurements are transmitted to the control room where the unit operators can see the chemistry conditions and alarms warn them of chemistry excursions. If a chemistry excursion occurs, the operators immediately contact the duty chemistry technician, who initiates the response action. Response to chemistry excursions could be improved by providing chemistry with direct access to the chemistry data via a computer network link.

Fuel integrity is assured by an effective monitoring programme. Regular monitoring of iodine and xenon ratios is used as an indicator of fuel condition in accordance with radiochemistry specifications. Total alpha measurement is performed if certain indicators from gamma spectrometry exceed a given value. In turn, if the total alpha measurements exceed a given value, alpha spectrometry is performed. Each of these steps indicates different degrees of fuel clad integrity degradation. The data from these measurements, along with pertinent plant operating data, are fed into a corporate computer application for a more sophisticated level of analysis of the data. These results are tracked continuously. Sipping tests performed during refuelling outages identify the number and size and location of individual leaks.

No systematic check is made of organic compounds exiting the demineralised water production plant, although it appears to be effectively removing organic materials in the raw water. However, some of the resin beds have seen many years of service and resins may begin to pass or leach organic material. The team suggested that chemistry periodically monitor organic material to avoid intrusion into the plant.

7.4. CHEMISTRY OPERATIONAL HISTORY

The Scheduling and Work Control (Planification, Ordonnancement, Contrôle, POC) team are responsible for gathering, evaluating and disseminating experience feedback within chemistry. For external feedback they rely heavily on GDL (via the Chemistry Liaison Engineer). Internally, they are represented on the various experience feedback forums established on the plant, and are the lead area in the interrelations with the Operations Department. They also compile and maintain the various chemistry performance indicators. Chemistry excursions are rapidly reported to outside departments as needed and the information is also rapidly disseminated inside the Chemistry Section.

Lessons learned are effectively incorporated into feedback sheets and, where necessary, training sessions are scheduled.

Analysts/technicians compile the daily analysis report sheets and enter the data into a corporate (GDL) computer application, A22. GDL uses this data to perform cross plant performance comparisons. Retrieval of data from the A22 application is very inefficient and does not include a graphics interface. In addition, since reports are only issued some six months after the data has been captured, the information is of little value to the plant in the short to medium term. Instead of using the A22 application, the POC team manually re-enters data from the analysis sheets into several internally developed spreadsheets in order to maintain and track their chemistry performance indicators – there is no computerised laboratory database on site. Since four units are being monitored this represents a high workload and the number of critical chemistry parameters trended is less than would normally be expected in other countries. The team saw this as a weakness in the monitoring programme and recommended that improvements be made to enhance the pro-activeness of chemistry interventions.

7.5. LABORATORIES, EQUIPMENT AND INSTRUMENTS

The laboratories are well equipped, with a number of instruments not commonly found in power plant laboratories, e.g. capillary electrophoresis and inductively coupled plasma atomic emission spectrophotometry (ICP-AES). A comprehensive range of equipment is available for tribology (oils/lubricants) analysis and the oils and lubricants programme is a particular strength of the Chemistry Section. Several laboratories are distributed across the two twin-unit site and these were found to be reasonably spacious and clean. The counting room areas were incorporated into the controlled areas fairly recently in the life of the plant and the floors were painted with decontaminable paint. In several areas this flooring is badly damaged and the underlying concrete has been exposed.

Post accident facilities have been installed at the plant to enable both reactor coolant liquid samples and containment air samples to be withdrawn under accident conditions, for both design basis accidents (DBA) and severe (beyond DBA) accidents. On-line equipment is available for measuring boron and activity in the liquid and activity in the containment atmosphere. Although several cabinets have been installed that allow for grab samples to be withdrawn, procedures for withdrawal and analysis of manual samples do not currently exist on site, as the corporate policy is that it is not intended that manual analysis will be carried out post accident.

A new corporate directive governing post accident samples (and other aspect of accident response) is in preparation and due to be issued shortly. In line with this it is intended that hydrogen monitors, and probably hydrogen igniters, will be located at various points inside the containment.

7.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS

EDF have expended a great deal of energy identifying chemicals/materials that are compatible with the materials of construction. This has led to the introduction of the PMUC (Produits et Matériaux Utilisables en Centrale – Products and equipment that may be used on power plants) programme at all EDF sites. The team noted several weaknesses in the control of chemicals and commercial products for non-chemistry applications throughout the site and recommended that improvements be made.

Receipt of tankers containing bulk acid and caustic at the demineralization plant is well controlled. Satisfactory personnel safety measures are in place, including the use of a “buddy system” with both individuals fully dressed out in the required personal protection equipment. A weakness of the bulk chemical reception programme is that no sampling and receipt analyses are performed to check that the delivered material is as described in the paperwork.

7.7. RADIOCHEMICAL MEASUREMENTS

An effective radiochemistry programme supporting plant operation, outages and environmental monitoring is in place. Adequate equipment is available in each hot laboratory and counting room to provide support for unit operations. As each twin unit has a separate facility, this provides the site with full redundancy in radiochemical capability.

The laboratories participate in a national inter-comparison programme that certifies that their equipment is operating correctly and that they have the capability to perform the required measurements. The certification is renewed annually.

STATUS AT OSART FOLLOW-UP VISIT

Appropriate action has been taken on the OSART recommendations and suggestion. Two of the three recommendations have been resolved and satisfactory progress has been made on the third. The one suggestion has also been resolved.

The Chemistry Department has made considerable progress in improving the quality of chemical analysis results. A comprehensive study was conducted to determine the detection limits and uncertainties for all instruments and online analyzers used for measuring chemical parameters associated with the plants technical specifications. Based on the results of this study and other implemented programme enhancements it is evident that the identified chemistry QA/QC issue has been successfully resolved.

The Chemistry Department also successfully addressed the potential concerns related to total organic carbon (TOC) intrusion through plant's makeup water system. During March of 2000, Corporate Chemical and Metallurgical Laboratories, at the request of Bugey, conducted TOC analysis at multiple plant locations to determine if organic intrusion into the primary and secondary plant systems existed. Based on these sample results, the plant system configuration, and the schedule for routine resin replacements, the determination was made that routine TOC sampling was unnecessary.

Based on concerns identified with the lack of sufficient data trending and proactive evaluation of critical chemistry parameters being performed by the plant, corrective actions were quickly implemented to correct the deficiency. Interim actions were put in place to enhance existing trending capabilities and the recent implementation of the MERLIN computer application has further enhance the Department's trending capability for key plant chemistry parameters. This new computer application is very effective and the trend data can easily be made available electronically to plant personnel. These actions have resolved the issue in data trending.

The programme for control of chemicals at Bugey has been enhanced since the OSART. The programme procedure has been revised, effective in April 2000, to include additional controls applied to non-PMUC approved chemicals. Specific controls are being established by the various plant departments which use chemicals. Plans are also underway to make the Industrial Safety Data Sheets available to plant personnel on the intranet by the end of 2000. While considerable progress has been made, management will need to maintain a continuous emphasis on proper implementation of the chemical control programme to ensure its success.

Overall the Chemistry Department has been both aggressive and thorough in its resolution to the issue identified though the OSART. The chemistry staff was very receptive to the identified improvement areas and in many cases went beyond the recommendations of the OSART with its implemented actions.

DETAILED CHEMISTRY FINDINGS

7.2. CHEMISTRY CONTROL IN PLANT SYSTEMS

7.2(a) Good Practice: The Chemistry Department has developed a technique for monitoring primary to secondary leak rates, using lithium as a chemical tracer, which is especially beneficial in instances where the primary means of detection, Nitrogen-16 monitoring, may be ineffective.

The principal leak detection system for primary to secondary leaks is monitoring of the Nitrogen-16 activity in the live steam at the exit of the steam generators (SG). This is supplemented by tritium measurement in the condensate or feedwater, Xenon measurement in the incondensible gases exhausted from the condenser and radioelement detection in the steam generator blowdowns. Tritium is especially useful in determining the presence of a leak because of the low detection threshold (< 0.5 L/h) and the precision of the method. However, it cannot be used to determine which SG is leaking. Similarly, Xenon detection is normally performed on the incondensible gases from the condenser and cannot be used for individual SG leak detection (it is possible to measure Xe in the live steam but it is difficult to sample). The principle means of monitoring an individual SG has been the detection of radioelements in the SG blowdown. The detection threshold with this method is variable, as is the precision (30 to 300 percent). The plant has developed the lithium detection method as an alternative means of determining the leak rate in a specific SG. Lithium is, of course added to the primary circuit as the pH adjusting agent and the method has the advantage that it does not require counting equipment or any additional chemistry instrumentation and the analysis time is short. It is thus a very rapid assessment method. The detection threshold, as reported by the station, is good (< 1L/h) as is the precision (20 percent). A relatively short equilibration period of about 8 hours is required.

This technique is a very good method for confirming the information provided by the Nitrogen-16 measurement system, but the real value may be in that it is still possible to determine leak rates in instances where the Nitrogen-16 method fails because of long delay times across the leak, such as in the case of a leak across a tube that was previously plugged (i.e. the plug is leaking). Development of this method has augmented the capacity to ensure the integrity of the steam generator tubes.

7.2(b) Good Practice: The primary systems resin management programme has made a significant contribution to the reduction of solid waste and reducing chemistry operating costs.

The design resin bed configuration for the chemical and volume control circuit (RCV) is two mixed beds for circuit purification followed by a side-stream cation bed, for lithium removal. Common industry practice is to use mixed beds that operate in the lithium/borate form, and specially prepared mixed resin (cation resin > 99 percent $^{7}Li^{+}$) is purchased. This resin is very expensive when compared with H^{+} form cation resin. The station's primary circuit resin management programme dispenses with the purchase of the expensive lithium form resin and takes advantage of the production of lithium-7 within the primary circuit by the neutron absorption reaction of boron-10.

One of the two mixed beds is loaded with $^{7}Li^{+}$/borate form resin. This is in use for normal primary coolant purification during operation. A new cation resin charge, hydrogen form (H^{+}), is then loaded into the other mixed bed vessel. The volume of cation resin loaded is equivalent to only the cation portion of a mixed bed charge, so the vessel is only part loaded. This bed is used for periodic lithium removal and is slowly saturated with lithium over several cycles. When the cation is saturated with lithium, an anion charge is loaded on top of the cation and is then saturated with boron. When the purification bed is exhausted, it is discharged to solid waste treatment. The other vessel then enters service as the purification charge and the emptied vessel is re-loaded with H^{+} form cation and placed in service as the lithium removal bed. The sidestream cation resin vessel is kept empty in case of need during an incident when it can be loaded with resin as required. To avoid saturation of either mixed bed during the shutdown oxygenation phase, the RCV demineralizers are bypassed completely, and the letdown diverted towards the deborating demineralizers of the primary effluent treatment and boron recovery system (TEP) system. The demineralizer bed common to both units, TEP 006 DE, is not used for deboration, being instead loaded with a stratified cation/anion bed which is then used for primary coolant clean-up during the shutdown oxygenation phase. This resin bed is also retained for use over several cycles.

This management programme has had a significant positive impact in reducing solid waste production and by reducing the number of resin change out operations, has contributed to dose reduction efforts while also contributing to a reduction in chemistry operating cost.

7.3. CHEMICAL SURVEILLANCE PROGRAMME

7.3(1) Issue: Chemistry quality assurance and quality control (QA/QC) practices do not include some internationally accepted best practices and are not always supportive of proactive action. A QA/QC programme has been implemented using criteria advised by the Groupe des Laboratoires (GDL). However, a number of weaknesses were identified in the programme. The following are examples:

- Limits of detection for each analysis have not been determined under specific plant conditions. The limits of detection indicated by an instrument manufacturer or determined by corporate laboratories are usually done under near ideal conditions and are generally not directly applicable at a specific site. The limit of detection for a particular analytical method is required to assess its suitability for measurement of a given parameter under plant conditions. The accuracy (how close the result is to the true value) and the precision (how repeatable the result is) should also be determined under plant conditions.

- Matrix matching of standards to samples is not performed. Unless it is known that there is no matrix effect, the standard solutions should contain approximately the same level of interferant (e.g. morpholine, boric acid or hydrazine under lay-up conditions) as is found in the sample.

- Control charts are not used. A control standard is run with each batch of samples but is generally only checked to determine if it is within a ± 20 percent tolerance band. The analyst/technician reports this result and it is checked later that day by the Scheduling and Work Control (POC) team to see whether there is a trend. This can result in the measurement being out of control limits before corrective action is taken. Industry practice is to use control charts to trend the performance of the method against the control standard. These charts are typically maintained directly by the analyst/technician who can take appropriate proactive action to avoid going out of control limits. In addition, normal practice when gathering the data for the statistical determination of the warning and control limit levels on the charts, is to use an interim 10 percent tolerance band for warning limits in addition to the 20 percent for the control limits.

- Two point calibrations are used for many instruments. Often these do not bracket the normal measured value, particularly for trace level (low ppb / µg/kg) analyses. Two point calibrations always give a linear response and extrapolation of this linear response can introduce errors at the lower concentration levels of the samples. Many of these trace level analyses are at, or near, the limits of detection for the method or instrument used and departure from linearity is common near the limits of detection. Error can be minimised by using a three (or more) point calibration and, if possible bracketing the expected measuring range. If the latter is not possible, the lowest concentration standard should be as close as possible to the measuring range to reduce the error of extrapolation. The error can be further reduced by curve fitting the calibration data.

- On-line sodium analysers are only calibrated once per month. While this is in accordance with the recommendations of both the manufacturer and GDL, manufacturer's recommendations normally do not anticipate operation of the equipment at or near the limits of detection of the instrument. Industry experience has shown that once per month calibration frequencies for sodium analysers operating at, or close to, their limits of detection is insufficient in regards to accuracy and drift.

- The number of errors associated with chloride measurement on the steam generator samples is high. On unit 2, eight percent of the analysis were in error since the beginning of the year, while on unit 3 this figure was 17 percent since the beginning of the year. In most instances, there did not appear to be a systematic re-sampling and re-analyses.

- Significant differences between online analysers on the steam generator blowdown samples (one analyser for each steam generator sample) are not investigated if the readings are below the reporting limit (e.g. 1µg/kg for sodium). However, in the absence of primary-secondary leaks, the samples are nominally the same. This comparison could provide an early warning indication of a possible instrument calibration problem, enabling proactive action (recalibration) to be taken.

- The results of the control standard analysis are not being used to identify possible weaknesses in analyst/technician capability and the need for retraining on a particular analysis.

- Correlatory inspections to check for analytical consistency are not systematically used. Typically one would expect that the measured pH additive would be checked against specific conductivity and pH, that measured cation conductivity would be compared against values calculated from measured anions, etc. to check for anomalies.

- Laboratory intercomparisons are not routinely performed within chemistry. GDL began a laboratory intercomparison programme in 1995 but have only issued three samples covering six primary chemistry parameters since then. This is insufficient to provide a true indication of a plant's performance capability. Typically, a good intercomparison programme would provide various samples several times per year to gather sufficient data for statistical evaluation.

Implementation of a comprehensive QA/QC programme enhances confidence in the correctness of the analysis and reduces re-work. Proactive interventions prompted by data evaluation within such a programme avoid the production of erroneous data, which in turn may prompt erroneous corrective actions.

Recommendation: The station chemistry QA/QC programme should be strengthened to increase the level of confidence in the correctness of the analysis and to improve the proactive nature of chemistry interventions.

Plant response (response given by: D. ALLARY and P. CABARET)

A table of detection limits and uncertainties has been drawn up for all measuring instruments and on-line analysers used for measuring chemical parameters monitored in accordance with technical specifications (boron, lithium, sodium, hydrogen, chloride, fluoride, sulfate, pH, conductivity, oxygen, sodium hydroxide).

The values recommended by manufacturers or EDF Chemical and Metallurgical Laboratories (GDL) were supplemented by the values of thresholds and uncertainties acquired through experience at the plant and adapted to measuring conditions. The procedures for calibration and use of the instruments concerned were modified.

Matrix effects, which could lead to calibration of instruments with solutions containing approximately the same concentration of interference products, were the subject of a bibliographic study carried out with respect to applicable GDL reference bases and existing procedures at the Bugey nuclear power plant. This study enabled us to take account of all possible interferences (morpholine, boric acid, hydrazine, etc.); it was supplemented by laboratory tests, which led us to create or modify sodium analysis procedures (SAA flame, SAA oven, SEA flame).

A drift check is now carried out for each measuring instrument to verify the functional capability of the instrument with a tolerance of +/- 20 %. Drift monitoring is carried out in the form of a table. Calibration is then carried out, and the results archived; a calibration standard is analyzed on an unknown basis, and a tolerance specific to each type of measurement is used to determine the validity of the equipment with respect to the measurement concerned. Prior to daily boron analysis, for example, a 1000 ppm-boron boric acid standard is analyzed with a tolerance of 1%. If the result, compared and interpreted by the technician, lies outside the authorized range, calibration of the equipment (electrode slope, sodium hydroxide concentration, etc.) is repeated. In the near future, the Merlin computer application will enable graphic tracking of measurement drift with respect to a standard, and comparison with defined tolerances.

Tests were carried out in late 1999 on sodium meters in units 2 - 5 to improve the relevance of calibration. The aim was to estimate the accuracy of measurements over a range from 0.5 to 150 mg/t and verify the absence of drift in on-line analysers between two monthly calibrations. With respect to on-line analysers in units 4 and 5, the “zero point” is now set using super-pure water, and calibration is then carried out using 2 sodium solutions (20 mg/t and 150 mg/t), giving three calibration points. The on-line analysers in units 2 and 3, which use different technology, are calibrated according to the principle of metered additions, with master sodium solutions diluted automatically using water from the Nuclear Island Demineralized Water Distribution System. The concentration of the master solution used was reduced from 10 to 2 ppm, to get as close as possible to the values of the calibration points, between 10 and 100 ppb (instead of 50 and 500 ppb previously).

The calibration frequency of the sodium meters was not modified due to the absence of drift observed over a period of one month. In addition, a comparison is carried out once a week between the value of the on-line analyser and a “manual” analysis carried out by SAA: in the event of a difference greater than 0.5 mg/t (no longer 1 mg/t, as was the case up to 1999), the on-line analyser is recalibrated. To anticipate a possible calibration problem with an on-line analyser, the action threshold for deviations between on-line analysers within the same unit on taking of daily readings has been cut from 2 mg/t (GDL threshold) to 0.5 mg/t. Intensified monitoring of the on-line analyser is then initiated, in addition to the necessary corrective actions (for example, checking of balancing of blowdown rates of the three steam generators).

These various actions led to updating of the memo “Program for testing of automatic chemical monitoring and control devices”, as well as the procedures for use of sodium meters.

An initiative has been launched to link up with a program of cross-comparison of chemical measurements. The request to the GDL received a favorable response for implementation by the end of 2000. In the meantime, an analysis based on solutions of unknown concentration supplied by the SODIPRO company was carried out in late 1999; this analysis concerned the following elements: boron, lithium, chlorides, fluorides, sulfates and sodium. Finally, an order was placed with the University of Barcelona to join up with the campaign of chemical analysis cross-comparison tests which it runs on behalf of 13 nuclear power plants in Europe (this involves 1 test in April/May and 1 test in the fall of 2000).

As a result of the high number of errors found in early 1999 with respect to chloride measurements in steam generator samples (8% in unit 2 and 17% in unit 3), specific precautions were implemented on sampling and preparation of samples prior to analysis. In the event of significant changes (> 5 ppb) or major differences between the values for the steam generators in the same unit (> 5ppb), a new sample is retaken on the same day or the following day. The aim is to achieve an error rate of less than 1% in 2000.

To confirm the consistency of the analyses, verification by correlation between cation conductivity and conductivity calculated on the basis of anion species is carried out when performance of the weekly measurement of organic anions by electrophoresis is carried out. This is traced in the weekly report, and comments are passed on to the teams of technicians. A correlation between measured pH and theoretical pH calculated on the basis of conditioning products is carried out each week when morpholine, hydrazine and ammonia measurements are performed.

In conclusion, the strengthening of this quality assurance program, combined with the development of trend analyses, enables a higher level of confidence to be guaranteed in the results of chemical analyses to our partners in the operations department, and enables better joint anticipation of potential problems.

IAEA comments:

The Chemistry Department has taken aggressive actions to improve the quality assurance of chemical analysis results. A comprehensive study was conducted to determine the detection limits and uncertainties for all instruments and online analyzers used for measuring chemical parameters related to the plant’s technical specifications. Matrix effects were also determined and applicable procedures were revised to incorporate the findings of these studies. Additional programme improvements have been made, including enhancements to the crosscheck program, to provide greater assurance of continued reliability and repeatability of analysis. Based on a review of the results of these studies and actual data analysis, it is evident that the implemented actions have been successful in resolving the identified chemistry QA/QC issue.

Conclusion: Issue resolved

7.3(2) Issue: The plant does not systematically check to ensure that organic compounds are excluded from entry into plant systems via the make-up water.

There is no scheduled periodicity for the analysis of the total organic carbon (TOC) of the demineralized water produced at the demineralization plant. A recent analysis by an independent laboratory indicated that the water treatment plant is effectively removing organics in the raw water. A study performed by GDL some time ago indicated that resin degradation was not a problem and that monitoring was not necessary. However, resins deterioration increases with age and can leach organo-sulfonates that may not be detectable by either conductivity or cation conductivity measurement prior to entry into the primary circuit or steam generators. At these points, the organic material will be thermally broken down to release sulfate. This could lead to corrosion problems.

Some of the demineralized water plant resins have seen some twenty years of service life and can thus be expected to show increased ageing effects, including increased leachate.

Suggestion: Consideration should be given to performing periodic monitoring of the organic content of the primary and secondary make-up water from the demineralization plant to ensure that organic intrusion into primary and secondary plant systems is avoided.

Plant response (response given by: D. ALLARY and P. CABARET)

A request was made by the power plant for total organic carbon measurements to be taken and a positive response was given by Corporate Chemical and Metallurgical Laboratories (GDL). Indeed, a series of samples are to be taken until March 2000 at different points around the plant: filtered raw water, outlet of ETA 2 line (old resin beds), outlet line of new resin beds. This is part of a national campaign to measure organics both in the make-up water and on the secondary circuit of several units at EDF plants.

The water production plant analyses will be complemented by analyses on unit 2.

The results will therefore be known before the OSART follow-up mission.

As for the water coming from the demin. plant, it is important to stress that the water goes through mixed resin beds where the officially-certified (PMUC) resins are changed out every five years, equivalent to about 2 million cubic meters of water produced.

Finally, so as to anticipate any ageing problems with certain resins in use for twenty years, refurbishment of the demineralisation plant will be pursued in parallel with the replacement of resin loads and the storage tank branch separation arms on the ETA 2 line.

IAEA comments:

During March of 2000, analysis was conducted at multiple locations to determine if organic intrusion into the primary and secondary plant systems existed. These samples confirmed that the concentrations of total organic carbons were as expected and that the water production plant continued to be effective in removing organics from raw water. Based on these sample results, the plant system configuration, and the schedule for routine resin replacements the potential for intrusion of organics into the primary and secondary systems is unlikely. No further actions are necessary to address this issue.

Conclusion: Issue resolved

7.4. CHEMISTRY OPERATIONAL HISTORY

7.4(1) Issue: The amount of data trending and proactive evaluation of critical chemistry parameters performed at the plant is not consistent with international accepted practices.

Data trending of primary chemistry parameters is limited to boron(B) and lithium(Li), to follow the co-ordination control diagram, and the chemistry indicator parameters, condensate dissolved oxygen(DO) and steam generator blowdown sodium(Na) and cation conductivity(CC) on the secondary side. In other countries, the guidelines issued by industry organizations recommend that sufficient critical parameters are regularly trended and evaluated in a manner consistent with proactive control to allow cross-comparisons among related parameters and systems, and enable underlying and slowly developing trends to be identified and corrected in a timely manner before they become problematic. The number of critical parameters recommended is considerably greater than followed at Bugey.

The plant's use of SG cation conductivity only may be insufficient for monitoring underlying secondary trends because of the chemistry regimes applied. Morpholine all volatile treatment (AVT) is applied on all units, thus providing a source of organic acids from thermal breakdown. Boric acid treatment is also applied, except on Unit 5, and this also affects the cation conductivity. Although a correction is made for boric acid in the CC trends that are followed, there is a masking effect from the background contributors and CC is a much less sensitive indicator of underlying trends than at plants using ammonia AVT. Calculated values of cation conductivity typically showed variances with measured values of 0.15µS/cm, which equates to a potential undetected chloride presence of around 10µg/kg.

Failure to adequately trend a sufficient number of critical parameters may result in undetected low level impurity ingress that can initiate long term degradation of the plant.

Recommendation: The plant should routinely trend sufficient critical parameters to ensure that they are able to identify underlying and slow changing trends that may become problematic and use this information to initiate proactive corrective action.

Plant response (response given by: D. ALLARY and P. CABARET)

All trend analysis work carried out has been brought together and listed in a chemistry technical file (No.4/99). This currently covers the following parameters:

- The EDF chemistry index, calculated using SG blowdown sodium, SG blowdown cation conductivity and condenser extraction oxygen values.
- Daily boron lithium ratio compared with EDF chemistry specification and technical specification limit values.
- Oxygen in boron water and make-up primary effluents.

– Primary-secondary leaks, comparing the results obtained using several analytical techniques.
– Radiochemistry indicators of first barrier status.
– Production of demineralised water.
– Production of effluents.

These appear on the weekly performance indicator analysis report, produced and distributed by the chemistry planning and analysis team (POC). They are discussed during internal chemistry and environment section meetings as well as during cross-functional meetings with the operations department.

They also appear in the monthly department report that is now accessible to all staff via the internal computer network.

Once the 'MERLIN' computer application is in place in May 2000, additional trend analysis will be performed on:

– Chlorides, fluorides and sulphates both on the SG blowdown and in the primary.
– Hydrogen and sodium in the primary.
– Boron, chlorides and fluorides in the spent fuel and reactor cavity pools, in the boron make-up tanks and in the safety injection accumulators.
– pH and phosphates in the component cooling water.
– Soda in the containment spray tanks.
– Oxygen in the hydrogenated gaseous effluents.

Significant efforts both in terms of organisation, equipment and human resources have been made so as to adhere to the deadlines and goals set.

IAEA comments:

Following the OSART, the Chemistry Department enhanced their reporting of chemistry data to plant staff to assist in the timely response to potential trends. This was an improvement over past practices however, they recognized that further improvements could be made. Efforts were then focused on implementation of the new MERLIN computer application. Since the implementation of the MERLIN computer application in May, the Chemistry Department has been able to further enhance its trending capability for key plant chemistry parameters. This system provides the necessary early indication of potential trends in plant chemistry such that they can be quickly addressed. This tool is very effective and the trend data can easily be made available to plant personnel electronically.

Conclusion: Issue resolved

7.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS

7.6(1) Issue: The programme for control of chemicals and other commercial products on site is insufficiently effective. In accordance with corporate directives, the plant has adopted the PMUC (Produits et Matériaux Utilisables en Centrale – Material and Equipment for use in power plants) programme. This classifies products in one of three levels:

- PMUC – fully approved: may be used without restrictions
- PMUC – with restrictions: may be used provided restrictions are adhered to
- Non PMUC: may not be used.

All EDF and contractor activities on site are governed by this programme and, in the case of chemical usage on site, only those chemicals complying with PMUC requirements may be used. Included in the requirements is that all containers shall be clearly labelled as to contents and marked PMUC, etc. Adherence to these requirements is not always achieved. There were a number of instances where chemicals that were not approved for use, containers of chemicals that were not labelled and containers with handwritten labels that contained chemicals different from what was written on the labels, were observed inside the nuclear auxiliary buildings. In addition, a number of instances were identified where non-PMUC chemicals, that had entered the plant prior to implementation of the PMUC requirement, had not subsequently been removed.

Examples were containers without proper PMUC labelling marked “Trichloroethylene” that did not contain Trichloroethylene, containers of grease and solvents that were improperly labelled and solvent containers standing uncapped in non-storage areas.

Inadequate control of chemicals and commercial products can result in personnel injury and damage to plant systems and components.

Recommendation: The station programme for the control of chemicals and commercial products should be strengthened to ensure only authorized products are on-site and that they are properly labelled and controlled.

Plant response (response given by: D. ALLARY and P. CABARET)

A review was carried out, coordinated by the plant PMUC (Products and Materials for Use in Power Plants) representative. This review led to the requirements, the organization in place at the plant and the role of the various players being clearly redefined.

The new organization memorandum D5119/NO/99001 “Organization for management of products and materials for use in power plants (PMUC)” states:

- use of products approved for use in power plants (PMUC-approved) is mandatory with respect to all safety-related equipment, and is recommended for non-safety-related equipment;
- all orders of non-PMUC-approved products or materials must bear a label stating “non-PMUC-approved product”; the user department is responsible for storage, distribution and use of such products or materials;
- in exceptional cases in which a non-PMUC-approved product is used on a safety-related system, the user department is required to carry out a risk analysis;
- in all cases in which PMUC-approved or non-PMUC-approved products are used, traceability must be ensured from ordering through to end use. Similarly, in the event of sub-batching, the product identification must be preserved (type, batch number).

Each department is responsible for the use of products within the department, by its staff or by contractors, which it employs.

With respect to the chemistry section of the measurements and environment department, the technical memorandum (D5116/NT/98057) “Management and monitoring of PMUC-approved products used by the chemistry section” explains the conditions of application of the organization memorandum within the department.

These requirements have been set out at the level of the chemistry-environment section of the measurements and environment department, which is particularly concerned by the use of industrial and laboratory chemical products (monitoring of decanting of industrial chemical products, labeling of laboratory flasks and circuit conditioning products).

IAEA comments:

The programme for control of chemicals at Bugey has been enhanced since the OSART. The programme procedure has been revised and now includes additional controls applied to non-PMUC approved chemicals. This procedure went into effect in April of 2000. Each plant organization has been requested to develop its own internal controls to implement the site procedure. The revision to the programme was communicated to the plant staff through the site newsletter. Plans are underway to make the Industrial Safety Data Sheets available to plant personnel on the intranet by the end of 2000.

While considerable progress has been made, management will need to maintain a continuous emphasis on proper implementation of chemical controls through methods such as self-assessments and field observations. The Procurement Department has considered requesting individual departments to conduct their own self-assessments and has also planned an audit of the programme by the Safety and Quality organization. Efforts such as these will be necessary to determine programme effectiveness and to identify further opportunities for improvement. Routine management walkdowns should also include observations in the chemical control area. Deviations identified during these observations could provide early indications of potential trends. With regard to implementation of the new programme, a schedule should be developed to track completion of planned actions such as the development of internal controls by the individual site organizations. Consideration should also be given to providing training to contract personnel on the changes to the programme as well as modifying any existing training on chemical control requirements provided to general plant population.

Conclusion: Satisfactory progress to date

SUMMARY OF STATUS OF RECOMMENDATIONS AND SUGGESTIONS OF THE OSART MISSION TO BUGEY - JUNE 2000

	RESOLVED	SATISFACTORY PROGRESS	INSUFFICIENT PROGRESS	WITHDRAWN	TOTAL
Management, Organization & Administration	1	2 1	1		4 R 1 S
Training & Qualification	4 1	1 1			5 R 2 S
Operations	1 1	4			5 R 1 S
Maintenance	1	1	1		3 R 0 S
Technical Support	1	2			3 R 0 S
Radiation Protection	2 1	4			6 R 1 S
Chemistry	2 1	1			3 R 1 S
TOTAL R (%) TOTAL S (%)	12 (41 %) 4 (67 %)	15 (52 %) 2 (33 %)	2 (7 %)		29 R (100 %) 6 S (100 %)
TOTAL (%)	16 (46 %)	17 (48 %)	2 6 %		35 (100 %)

DEFINITIONS

Recommendation

A recommendation is advice on how improvements in operational safety can be made in the activity or programme that has been evaluated. It is based on 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.

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 or to point out possible superior alternatives to ongoing work. In general, it is designed to stimulate management and supporting staff to continue to consider ways and means for enhancing performance.

Good Practice

A good practice is a proven performance, activity or use of equipment which the team considers to be markedly superior to that generally observed elsewhere. It should have broad application to other nuclear power plants and be worthy of their consideration in the general drive for excellence.

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.

ACKNOWLEDGEMENTS

The Government of France, the Nuclear Installations Safety Directorate (DSIN), Electricité de France (EDF) and the staff of Bugey Nuclear Power Plant provided valuable support to the OSART mission to Bugey. France has provided significant contribution to the OSART programme by sending experts to many other OSART missions, in providing consultants to review the OSART programme and in hosting OSART missions to eleven French plants. Such close cooperation between France and the IAEA in all nuclear activities has established many personal contacts and a common basis for efficient work.

Throughout the whole OSART mission, the team members enjoyed excellent co-operation and fruitful discussions with Bugey Nuclear Power Plant managers and staff, other EDF personnel and staff of local and national authorities. Information was provided openly and in the spirit of seeking improvements in operational safety. There was a rich exchange of knowledge and experience which contributed significantly to the success of the mission. In particular, the Bugey managers were very receptive to comments and suggestions made by team members and seemed dedicated to achieving operational safety improvements, where possible. Many personal contacts were also established that will not end with the completion of the mission and submission of this report. The efforts of the plant counterparts, liaison officers, interpreters and the secretary were outstanding. This enabled the OSART team to complete its mission in a fruitful manner. The IAEA, the Division of Nuclear Installation Safety and its Operational Safety Section wish to thank all those involved for the excellent working conditions during the Bugey Nuclear Power Plant review.

OSART MISSION TEAM COMPOSITION

EXPERTS:

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Review area: Management, Organization and Administration

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Nuclear Plant Chemistry, Eskom
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Review area: Chemistry

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Review area: Technical Support

HANSSON, Bertil - IAEA
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Review area: Maintenance

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Team Leader

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Review area: Training and Qualification
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Review area: Radiation Protection
Chemistry