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INTERNATIONAL ATOMIC ENERGY AGENCY

REPORT

OF THE

OSART

(OPERATIONAL SAFETY REVIEW TEAM)

MISSION

TO THE

TRICASTIN

NUCLEAR POWER PLANT

FRANCE

12 to 31 January 2002

DIVISION OF NUCLEAR INSTALLATION SAFETY

OPERATIONAL SAFETY REVIEW MISSION

IAEA-NSNI/OSART/02/114

PREAMBLE

This report presents the results of the IAEA Operational Safety Review Team (OSART) review of Tricastin 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.

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.

CONTENT

INTRODUCTION AND MAIN CONCLUSIONS

INTRODUCTION

At the request of the government of France, an IAEA Operational Safety Review Team (OSART) of international experts visited the Tricastin Nuclear Power Plant (NPP) in France, from 14 to 31 January 2002. 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; Chemistry; and Emergency Planning and Preparedness. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

The Tricastin OSART mission was the 114th in the OSART program, which began in 1982. The team was composed of experts from Canada, the Czech Republic, Germany, Mexico, Spain, Sweden, the United Kingdom, the United States of America, and France the host plant peer, together with the IAEA staff members and observers from China, Pakistan and the IAEA. The collective nuclear power experience of the team was approximately 320 years.

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

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

MAIN CONCLUSIONS

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

– The professionalism of the staff which is enhanced by a strong training program;

– The management initiatives and tools to achieve rapid and broad improvements in a number of areas has significantly improved over the last few years;

– Strong leadership and control of safety related activities coupled with a sense of management planning is communicated professionally and consistently by the management team and now showing positive results in key areas;

– The material condition of Units 1 and 2 and the housekeeping have dramatically improved, with thorough plans to improve unit 3 and 4 at least to the same standards.

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

– Despite the improvements at the plant in the last two years, there continues to be problems associated with adherence to policies, procedures and instructions. Although workers are trained to know what is required of them, individuals sometimes feel free to determine for themselves when rules should be followed. Some managers do not always intervene to correct such performance.

– The foreign material exclusion practices at the plant are weak.

– EDF has not developed a clear corporate policy that prohibits the consumption of alcohol prior to work or during the workday in accordance with good international practice and IAEA safety guidance.

The Tricastin plant is going through a period of widespread transition. Three years ago the performance indicators for the plant showed weaknesses in many areas. Today the indicators show much better performance. In other cases it is too soon to see improvement. Because of this transition period, the team provided recommendations in some areas where the plant has already embarked on aggressive improvement activities. The team encourage the plant to maintain a long term and tenacious attitude as it pursues improvements and also periodically assess the success and make necessary corrections.

An important element of the OSART review is the identification of those findings that exhibit positive and negative safety cultural aspects of operational safety performance. The OSART team used the guidance provided in INSAG-4, INSAG-13 and IAEA Safety Report Series No. 11 to assess various organizational and technological aspects of operational safety culture at the Tricastin NPP. The team concluded the following:

– The staff members are not always the drivers of change, the expectation is often that the change is always from the top down. Common feeling is not yet that some change comes from the bottom up, although management aims at involving people through Total Quality Management.

– Some standards are not clearly set and not adopted by some staff and managers. Cultural issues may hinder future development in this area and needs to be accounted for.

– There appears to be an insular environment with little knowledge of industry best practice outside of EDF.

– In some areas there appears to be a culture of compliance rather than a culture of striving for excellence.

On the other hand, the team recognized the good pride of their nuclear power plant that the management and staff felt and was impressed with the staffs professionalism and their desire to improve. Senior management should continue to encourage and reward the staff's behavior in this area.

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

1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

1.1 CORPORATE ORGANIZATION AND MANAGEMENT

Tricastin NPP is a four-Unit PWR plant of 900 Mwe each, situated in Provence, southern France and is operated by Electricité de France (EDF). The plant manager reports to the Director of Nuclear Power Generation Division, (DPN) who in turn reports to the Associate Director-General. The plant manager attends meetings held by the Nuclear Generation Division located at EDF headquarters in Paris.

The Nuclear Generation Division is supported by:

- Corporate FTC departments
- Corporate technical support departments, covering operations, chemical, metallurgical and engineering support for operations.

Engineering support, which is accountable to the Associate Director-General via the Engineering Division & Services, is also available for supporting all the nuclear sites, including Tricastin NPP.

A detailed job description for the plant manager is signed by the Director of Nuclear Power Generation Division, (DPN), which formalizes his authority.

Corporate resources are extensive to support the Nuclear Generation Division’s objective to safely operate the EDF nuclear fleet. The Operational safety organization within EDF has four layers of safety committees:

a) Nuclear safety committee (CSN), chaired by the president of EDF (national)

b) Operational safety committee (CSNE), chaired by Director of nuclear generation division. (national) – Tricastin plant manager attends this meeting.

c) Safety review committee (CSN), safety technical committee, COMSAT plus GTS. Chaired by the plant manager, and/or the associate directors(SITE).

d) Daily safety meetings, chaired by the on site shift manager.

The auditing arrangements for each level of the safety committees provides for safety at every level.

The objectives of the Nuclear Power Generation Division (DPN) are to produce energy:

- Safely (technical and human reliability)
- Cleanly (release and waste management)
- Cost effectively (cost control)

DPN along with its nuclear fleet has a policy of openness and transparency in its relations with local communities, the media and the regulator.

EDF does not have a comprehensive strategy or policy that prohibits the consumption of alcohol during the workday, including on Nuclear Sites. As an example, alcohol is served in the plant restaurant limited to 25cl for wine or 33cl for beer. The team provided recommendations for the plant and the corporate organization on this issue.

1.2 PLANT ORGANIZATION AND MANAGEMENT

The plant has approximately 1280 EDF employees. In addition, many contractors are normally on site for outage work.

The plant's senior management team is comprised of the plant manager with three associate directors covering power operation, outages and logistics. In addition, they are supported by six management advisors. The advisory functions include plant safety/quality, plant technical, communications, human resources, administrative advisor and a quality management advisor.

The senior management team is supported by ten departments, that include operations, chemistry & environment, industrial safety & radiological protection, mechanical maintenance, I&C/electrical maintenance, modifications, site logistics, nuclear engineering, co-ordination and buildings & property. Each of the Associate Directors has responsibilities for some departments associated within their core area of responsibility.

The plant has support from DPN and the corporate technical and engineering departments.

The management team has developed and deployed its strategic objectives required to ensure the future success of the plant.

Management key objectives are to:

a) Design and deploy an integrated and comprehensive management system within quality-managed processes (The Information Technology (IT) systems were improved on site to match the processes).

b) To ensure staff at all levels understand the issues and strategy and were offered the opportunity to participate in the deployment.

The plant has improved in a number of areas since 1999 as demonstrated by performance indicators, however continued effort is required if additional improvements are to be realized, so the plant can achieve its own goals in performance excellence. Initiatives such as the advanced recruitment policy (GAEC) and human performance group development, all supported by management, will assist in raising the standards throughout the workforce.

The plant has also pursued an aggressive program to improve the housekeeping and material condition of all four units. This program has been implemented in units 1 and 2, but the work in units 3 and 4 remains outstanding. The team made a recommendation to continue the program and to assure sustainability of actions implemented.

Demonstrable progress has been made to embed the policy of "Questioning attitude" and "Thoroughness" into the improvement of the workforce. Significant management processes have been initiated at the plant. While these processes are beginning to show success, there remains a gap between the expectation of managers and the results observed. The team provided a recommendation in this area.

The turnover of staff for the next 10 to 12 years will be significant when compared to the history of the plant. The reduction in experience across the workforce from its current high level is reviewed to ensure that any effects do not impact on nuclear safety.

Nuclear safety considerations are paramount throughout the plant and its operation. The structures and working methods contain elements specifically designed to ensure that a safe operational status is maintained at all times, including the unit on outage. Management need to remain diligent to ensure that these measures remain effective.

1.3. QUALITY ASSURANCE PROGRAM

The principles of the nuclear safety policy are derived from the EDF president, to the nuclear plant generation division, to the plant manager and finally the shift manager.

Copies of the EDF president’s letters on nuclear safety policy are issued to all staff along with an accompanying letter from the plant manager. The safety policy has seven principles:

- To carry the public confidence with respect to nuclear power.
- Safety culture as per INSAG 4
- Compliance
- Improvement via Total Quality Management (TQM)
- Comparison of performance indicators with WANO indicators
- Balance the economic realities with available resources
- Transparency throughout.

All of these principles are in the Safety Handbook issued to all employees of EDF.

The Quality management advisor heads the quality management advisory unit.

The department carries out numerous audits to QA standards. The detail is contained in the site quality manual, which sets out the structures and systems needed to ensure a quality document process. The audits cover some 34 themes, each of which has an owner and each is audited every 5 years as part of a rolling program.

The integrated quality processes link together, such that the organizational documentation, which amount to 694 documents, have owners, are audited, updated and tracked via the integrated computer system.

1.4. REGULATORY AND OTHER STATUTORY REQUIREMENTS

The roles and responsibilities of the regulatory body were covered in the presentation at which representatives of the site and the regulatory body (DSIN) were present.

Tricastin NPP has two regulatory inspectors identified for the site. They have permanent regional offices in Lyon. The regulator does not have an office on site but is provided with facilities as required on occasions.

The regulator carries out at least 20 planned inspections per year and notifies the site approximately 2 weeks before the inspection. This allows the site to gather information pertinent to the area or procedures under inspection. In addition to this the regulator will carry out a number of additional inspections particularly for the unit on outage.

In 2001, 13 work site and 13 topic-based inspections were carried out. About 25% of all inspections are not announced. The unit on outage inspections are in addition to the planned inspection regime.

Any findings from the inspections are dealt with through formal processes with responses provided by the plant, normally within a 2-month period. The responses and any subsequent actions are tracked by the site.

Communications concerning any issue between the site and the regulator are well established and cover a range of situations including the requirement to inform the regulator immediately, following a significant event.

The regulator attends technical meetings periodically, which allows informal discussions to take place on a number of subjects. For example, the regulator is showing an encouraging interest in the benefits of Human Factors investigations.

The regulator emphasized the progress the plant has made in the last 3 years, in particular, its openness policy.

Although the plant and the regulator have a good working relationship, the regulator ability to maintain its safety independence at all times, was discussed. One of the means by which regulatory independence is maintained, is the use of the other site regulatory inspectors who carry out a selection of the inspections at Tricastin NPP, which in effect, audits the inspection standards of the nominated site regulatory inspectors and the plant, at the same time.

1.5. INDUSTRIAL SAFETY PROGRAM

It is encouraging that the plant's industrial safety record has made notable improvement over the last year.

The industrial safety department is very active in the pursuit of improvement in industrial safety. Accidents and injuries are logged in a database, "Ariane". The plant has a health & safety committee which meets regularly. The Industrial safety department operates a low-level events system as one of the mechanisms in improving industrial safety. The department is responsible for identification, authorization and use of all chemical products on site, ("OLIMP" data base) which will be loaded onto the site network in approximately two months.

Numerous communications media are used to promote good industrial safety practices, including the distribution of an industrial safety magazine.

Whilst industrial safety has improved, further improvements are required particularly in the use of personal protective equipment, such as head, ear, eye and hand protection. Management in the handling of substances such as Fyrquel, need to be improved, along with the clarity and enforcement of the smoking policy. The team made recommendations in this area.

Policies are in place to improve industrial safety but they are not always adhered to by workers in the field. Further increases in the rigorous enforcement of the industrial safety policy are required to improve the acceptance of international industrial safety practices.

1.6. DOCUMENT AND RECORDS MANAGEMENT

The plants documentation processes and systems have been designed around the management strategy and policies. The detailed structure of the processes is based on QA/TM principles. The quality management advisory unit (MSQ) supports and audits the quality standards within this area, which includes common formats across a range of document types.

All documentation is managed through the comprehensive and integrated computer system, which means that updates and modifications to documentation can be carried out efficiently and by the person or section responsible identified in the process.

The workforce accesses documentation via the computer system at the point of work. This ensures that the documents are the latest issue.

The cross referencing of documentation is not yet fully comprehensive. This is ongoing and will be completed before the end of 2002.

DETAILED MANAGEMENT, ORGANIZATION AND ADMINISTRATION FINDINGS

1.1. CORPORATE ORGANIZATION AND MANAGEMENT

1.1(1) Issue: EDF and the nuclear plants within EDF do not have a comprehensive strategy or policy that prohibits the consumption of alcohol prior to work or during the workday, including on nuclear plant sites.

- Alcohol (wine and beer, limited to 25cl for wine and 33cl for beer) is served in the restaurant at Tricastin NPP.
- 6 previous OSARTs at other EDF sites have raised this as a concern.
- At the time of the OSART follow-up mission to the 6 previous sites, 3 had fully implemented the recommendation and 3 had still to implement the recommendations fully.
- Serving of alcohol on site condones the consumption of alcohol off site during the working day.

The current policy for sites, which still have access to on site alcohol, is inconsistent with safe nuclear operations by its support of consumption of alcohol by its staff, during the working period.

Recommendation: EDF should establish and issue a clear corporate alcohol policy directive to reflect acceptable international standards within its nuclear sites.

Recommendation: Tricastin NPP should establish and issue a clear directive on alcohol policy to reflect acceptable international standards within its nuclear site pending the issue of a corporate directive.

1.2. PLANT ORGANIZATION AND MANAGEMENT

1.2(1) Issue: Housekeeping and material condition standards in units 3 and 4 needs improvement and are not at the same level as has recently been reached in units 1 and 2.

Tricastin has pursued an aggressive program to improve the housekeeping and material condition of all four units. This program has been implemented in units 1and 2, however significant shortcomings remain in units 3 and 4. See detailed findings in the Maintenance and Operations sections of the report.

Milestones for completing activities in units 3 and 4 are:

Painting of walls, floors, ceilings and steelwork commencing March through to mid year 2003. A detailed study has been carried out to support the policy, not only for units 3 and 4, but for other key areas across the site. Budgetary provision has already been allocated for completion of the whole program.

Unless the refurbishment of units 3 and 4, along with other key areas across the site is carried out, it will be difficult to sustain the improvements already achieved on units 1 and 2. (see issue 3.2 (1) and 4.6 (1), material conditions).

Recommendation: The plant should continue to schedule into its business plans, the upgrade requirements for housekeeping and material condition in units 3 and 4. The plant should also focus on maintaining areas that have been refurbished by considering the introduction of veritable housekeeping walk downs.

1.2(2) **Issue:** Although significant management processes have been initiated at the plant, there remains a gap between the expectation of managers and the results observed. The team noted that demonstrable progress has been made to embed the policy of "Questioning Attitude" & "Thoroughness" into the improvement of the workforce, however the following was observed:

- In the Unit 1 Active ventilation system a member of the maintenance department entered the ventilation plant room without closing the door, bypassing the Iodine filter. This was raised by the plant as a significant event, as he did not follow the requirement for work and access to this area.
- A safety related temperature sensor was not routinely maintained inside it normal maintenance period. It was maintained inside its safety period limit. However the plant does not monitor the ratio of safety related plant equipment maintained inside the normal maintenance period versus the maintenance completed between the technical & safety periods.
- The plant did not identify or question the need for the temporary shielding adjacent to seismically qualified spent fuel cooling pumps to be seismically assessed.
- Some workers do not correct industrial safety problems when other workers are involved.
- Some plant deficiencies do not have deficiency tags.

If the policy of "Questioning Attitude" and "Thoroughness" is not fully accepted at the working level, the plant could miss opportunities to correct problems with operational safety.

Recommendation: The plant should continue to tenaciously pursue its program to instill a "Questioning Attitude" and a "Culture of Thoroughness" in all plant workers. The process requires a long period of time before it is embraced throughout the organization. Periodically throughout the period the plant should review the success of the program to ensure that high performance is sustained and make necessary enhancements to the program to meet management expectations and to be in line with IAEA safety standards and good international practice.

1.2(a) **Good practice:** Management initiative to improve plant performance.

The OSART review team noted that Tricastin NPP has achieved rapid and broad improvement in a number of areas over the last few years. The management tools used to achieve these results collectively are an effective means to achieve rapid improvement.

Strong leadership and control of safety related activities coupled with a sense of management planning is communicated professionally and consistently by the management team.

The programs that make up this good practice are:

a) The forward thinking management lead strategy formulated approximately 2 years ago has been supported by an effective integrated information system which links all the key business objectives such as, business plans, action tracking, training, documentation updates, performance indicators which are accessible to all users.

b) The anticipated loss of competencies over the next 10 to 12 years has been recognized as a major future issue and the replenishment program is ongoing. Both corporate and plant management are fully supporting this program.

c) It was recognized that the interface between human resources department, training department management teams and specific training representatives within each department has become a means of improvement at Tricastin NPP.

d) Operation department training is supported by committed management involvement, such as attending and evaluating of training in classroom and on the simulator including the observations and operator assessments.

   Managers and supervisors are also involved in the design of new training courses within operation department.

e) In order to unite staff across all departments, Operations developed a document entitled “Operations Nuclear safety requirement”. All departments shared in these straightforward requirements to improve the performance of the plant in terms of nuclear safety, industrial safety and radiological protection and availability. The document aids other departments to understand what is essential to safe and reliable operations.

f) A contractor monitoring program has been implemented that directly contributes to the improvement of safety practices at the job site. The review team recognizes the deployment of the “Industrial safety challenge” supported by management inspections in the field, as an important mechanism to stimulate improvements in this area.

g) Tricastin NPP is the first plant in the EDF fleet to implement the status-oriented approach in the emergency planning area. The staff took a leading role to develop and to implement the procedures in co-operation with the Bugey training
   the improvements included, procedures to improve on site protection of staff and the issuing of potassium iodine tablets. Improvements in information transfer and communication between the “Poste de Commandement (PC)” have improved exercise performance.

h) Significant improvements in procedures, supply and use of equipment, training regimes plus a substantial increase in the number of on-site formal emergency exercises per year, have raised the standards of emergency preparedness markedly.

i) The development of the Human Factors Network provides for training one or two human factors evaluators in each plant group. These people will lead the human factors development within their group, they will ensure that the needs of their group are represented in the development of the human factors program, and they will report and analyze human factors issues.

These programs support the achievement of overall improvements towards higher standards and encourage the plant to continue to move forward with the same determination as has been demonstrated over the past 2 years.

1.5. INDUSTRIAL SAFETY PROGRAM

1.5(1) Issue: Industrial Safety policies are not always being adhered to by workers in the field. Managers and supervisors in the field need to increase the rigorous enforcement of the policies to improve the acceptance of international industrial safety practices.

– Several persons, are seen every day without a hard hat.

– 20 to 30 persons are seen daily without hearing protection.

– Although noise level zone diagrams are posted in the machine room (Turbine Hall), the practice of having two different hearing protection levels within what essentially remains a very noisy area, gives conflicting messages to staff about the acceptability of noise in the work place.

– Staff working adjacent to excessive noise, but not in the same work party, do not question the need to wear ear protection, e.g.; on a visit to the heavy mechanical workshop, loud & continuous noise came from building work machinery in an adjacent open plan room. The builders wore ear protection but EDF staff, only 2 meters away, didn’t.

– RP subcontractor at entry to unit 3 not wearing gloves, other workers did not take corrective action.

– Smoking inside of buildings (numerous cigarette butts found inside buildings). Although the practice is to be able to smoke in the control room and tagging room, the tagging room does contain 6 months of official records. At present there is no general, across the site, formal policy for smoking.

– Car parked inside the turbine hall.

– Contractor drilling holes in the turbine hall floor without eye protection.

– Central chemistry laboratory fume hoods are not tested to check for adequate airflow.

– Poor lighting in pump room 3EAS-001-PO.

– In the area for storage of chemicals associated with Unit 1 and 2 laboratory, chemical protective aprons or shield, were not available, even though the area contained glass carboys of 96% concentrated sulphuric acid. The area did not have eye washers or emergency showers. The nearest water was approx 30 meters away via a complicated route.

- Oily waste stored in an unlabeled barrel adjacent to GFR pump unit on unit 3.
- In area of unit 3 steam generator a scaffold was being dismantled with urgency, there was no safe working area below the 10-meter scaffold.
- Lack of clarity and implementation of the smoking policy.
- Acid on floor adjacent to emergency batteries 4LBC001 BT & 4LCA001 BT.

Whilst improvements in the plants industrial safety record have progressed over the last 12 months, it is unlikely that this will be maintained, unless industrial safety attitudes and practices across the site continue to improve.

Without rigorous enforcement standards for industrial safety work practices, industrial accidents and plant equipment damage could result.

Recommendation: The plant should ensure that its industrial safety policies are clear and rigorously applied and complied with by all staff throughout the site.

The review and subsequent actions should be seen as management led and rigorously enforced by all levels of supervision throughout the site, including contractors, to ensure that the actions of workers in the field, lead to a continuous improvement in industrial safety across the whole site.

1.5(2) **Issue:** The plant does not have a consistent approach in the arrangements and management associated with the handling of Fyrquel fluid.

The team observed that several actions had been taken to improve the material condition in the area of the Fyrquel tanks, filters and pumps on all four units, however the following observations were made:

- Barriers have been placed around several valves with a temporary paper sign posted to indicate that there were Fyrquel leaks present. For example, valve 2GPV024VV. Under the valves several absorbent pads covered the floor.
- The plant has undergone two shutdowns as a result of Fyrquel leaks on a flexible hose and a servomotor.
- The plant has a high annual usage of Fyrquel fluid on each unit, indicating leakage on the system.
- A technical problem with a regulating valve on all the pump units has existed for at least 10 years, causing Fyrquel to leak from the system, in spite of a modification to eradicate the problem.

- Unit 3 – In the Fyrquel instrument cabinet the labels on the sample bottles were not adequately attached. Fyrquel oil was seen on the lower part of the cabinet and unauthorized operator aids were taped to the inside of the cabinet door.
- Unit 4 – The Fyrquel instrument cabinet contained several oily pad locks and an oil soaked procedure for a surveillance test.
- All four units had dirty warning signs stating "Attention Fyrquel". This does not properly support the important safety message that Fyrquel is a hazardous substance and that failing to take the correct precautions, could lead to personal injury.

The area around 2GPV 024 VV pumping unit had a temporary poster giving advice such as:

- " Do not expose the product to over 50°C".
- " Protective glasses to be worn when handling this product.

This was not the same advice posted at the pumping units for each of the units 1, 2, 3 and 4, which was: "Attention Toxique**"**

1) If accidentally contacted with skin, wash with plenty of water, and if necessary take a shower.
2) Do not touch food before washing hands.
3) If contacted with eyes, wash the eyes with clean water for at least 15 minutes.
4) Go to the medical

This is not consistent with the instructions in the material hazard data sheet "Fiche de Données de Sécurité", provided by the manufacture which covers comprehensive advice and instructions for inhalation, ingestion, contact with the skin and eyes, measures to be taken in event of a spillage, handling and storage, and control of exposure/individual protection.

Fyrquel is a toxic and hazardous material which must be handled with adequate safety precautions and controls. Fyrquel not only has the immediate risks associated with eyes, skin and ingestion, there are also long term health issues which need to be understood and respected.

Without protective measures and adequate precautions for the use of Fyrquel, serious personnel injury could result.

Recommendation: The plant should review and resolve their current technical, procedural and communication issues for handling Fyrquel.

2. TRAINING AND QUALIFICATIONS

2.1. ORGANIZATION AND FUNCTIONS

The Human Resources Advisory Group is a major contributor to overall function of support for training design and oversight. The human resources plant advisor (Chef de Mission), is responsible for the definition of policy, strategic co-ordination, development of proposals and overall monitoring of performance, working closely with the training providers and the heads of departments. The specialists within the department are available to maintain an overall "big picture" focus for training needs at Tricastin NPP.

An action plan was established based on feedback in 2000 from the regulator and internal audits and assessments requesting improvement in the overall training function at Tricastin NPP. The action plan, responses to tracked items, status of responses and improved functions are monitored by human resources but only closed following review by the on site QA Advisory Group for Safety and Quality. The action plan has proven to be effective and is in the process of continuous improvement. A review of the actions was performed and verified as complete or in progress during this mission.

The operational responsibility for the implementation of this policy is performed by the manager of the human resources advisory group and implemented by his specialist. This specialist has the overall responsibility to work with the other departments within the plant and training to ensure task analyses, work files and training skills are implemented in an effective manner.

Within the specific departments of the NPP, training representatives maintain the training programs and ensure skill sets are tracked and maintained for the department manager. These training representatives interface routinely with the human resources specialist who functions as an on site consultant. The training representatives are responsible for keeping and updating the individual training records for all training matters. These training representatives are responsible for maintaining the official records and files for each employee. A computerized system of attendance is maintained within the site training department and is utilized by the training representative to maintain attendance. One suggestion was made to encourage the human resource specialist to revise the policy covering attendance to delineate the official record and when the computerized system should be used for updates.

The training representatives who meet routinely as a group work within the departments to determine training course requirements for the year and send notices to the training department notifying them of the future attendance of their staff at site and corporate courses. Although the training department provided effectively maintains a daily update of attendance, the official ownership of the training program is with each department within the plant. During the mission excellent interface between the human resources department, the training representatives within the plant departments and the training department was observed. NPP senior management provides training coordination. The operational departments perform needs analysis, shadow training and grant authorizations for nuclear safety work. The site training centre, operations training centre, professional training services (corporate SFP), part time trainers and external organizations provide design implementation and course management.

Tricastin NPP does not presently have a simulator, therefore the training is performed at the Bugey national training centre, sixty (60%) per cent of the training is carried out on site. In 2004 a site specific simulator should be completed at the Tricastin NPP site which will increase the amount of site training.

Job task descriptions have been developed for each job on site and are maintained with training files and the individual training program which is performed annually during performance reviews for each employee. These skills criteria are then used in assessment guides for nuclear safety authorization. The nuclear safety authorization process is based on skills that are referenced for each function and based on the task analysis and objectives. This ownership of nuclear safety authorization is very positive.

Many methods of training are utilized at the plant for assurance of maintaining qualification other than the classroom and simulator. To ensure skill levels are maintained, the manager and training representative administer this process through each department. These include; tutoring, shadow training, cross functional training, situational team training, coaching and individual project development. These are all supported and implemented by management staff. This use of multi faceted training is conducive to promoting effective training.

This strategy has been implemented within all departments on site. Part time trainers also provide three hundred and eighty (380) man-days of training for the training centre. This group is organized, trained and scheduled along with the permanent training staff. Seventy-six part time trainers are in the program. The part time trainers club was recognized by the team as a good practice. The instructors provide a bridge for support, feedback and interface with their departments and reinforce the strong support and ownership of plant management to training.

A program of shadow training is also implemented within the training structure. It is based on a signed agreement between the manager, an assigned tutor and the trainee. At the present time there are one hundred and twenty eight (128) trained tutors on site. The agreement contains the training plan for the necessary qualifications needed for the assigned function. Evaluation is performed routinely and an assessment of status and improvement maintained every two years or at performance appraisal intervals.

It should be noted that a yearly training plan is designed and maintained within each department. Every department has a standard training plan (PTF) developed for each function that consists of courses identified by the department manager as a part of the employee improvement plan. The individual training plan (PIF) is then compiled after an individual appraisal and training interview between the person and their immediate supervisor. The training files and tracking methods for the employees are well structured and implemented and appear to be uniform across the departments. Future plans are to better define each plan and ensure thorough consistency.

2.2. TRAINING FACILITIES, EQUIPMENT AND MATERIAL

Each training site reviewed and evaluated was well prepared and maintained to provide effective training. The training material is well developed and based on identified tasks, objectives and lesson plans. The classrooms are all well equipped and are supplied with the necessary training tools. The simulator facilities at Bugey are well equipped and the simulator fidelity appears to be very good. Material for training and the training
scheduled for delivery in 2004 will provide and encourage even more effective training. Mock ups

are also available in many of the classrooms for Field Operators, Maintenance and I&C and other functions. Maintenance training is also provided at a national training

In addition, the site has a SIPACT simulator used to visualize physics phenomena which is also used for key personnel in the EPP and SEPIA simulator is especially used for steam generator tube rupture.

There is a designated area and program for fire fighting training.

2.3. CONTROL ROOM OPERATORS AND SHIFT SUPERVISORS

Initial operator training is conducted at the site level and Bugey nuclear training centre. Refresher training is also conducted on site, at the Bugey 900 MW simulator and by using SEPIA and SIPACT on site.

The operations crews receive two weeks of full scope simulator training per year, one course concentrating on technical aspects and the other on team situational training focusing on soft skills. The technical refresher training is composed of topics selected at corporate level (40%), site level (40%) and from crew requests (20%).

A monitoring system is set up to keep track of identified skills used in the field. The site simulator input in the simulator program is based on this system. Additional training on the site simulators SEPIA and SIPACT rectifies any areas identified by the annual training feedback report.

The management at Tricastin in the operations department regularly attend and observe the training at the site and at Bugey national training centre. The observations are used for assessment of the training program and the comments are provided as feedback and input into the future training. This attendance and program feedback provides a good example of management support of training.

The Operations training department works closely with operations and human resources and have formulated and implemented an effective program for evaluating shift managers and operations managers prior to appointment .

2.4 FIELD OPERATORS

Field operator training was reviewed from task analysis through final program development. A CIF, individual training file, is maintained for each employee and contains training completed and planned and includes safety and technical authorization certificates. An exercise was observed that was coordinated between the on site SIPACT, classroom and plant, where tags were placed to simulate a steam leak. This was found to be effective. The Operations training site manager ensures the programs and services are provided as necessary to the plant. The Field operations training was found to be generally effective in meeting the operations department needs. However, the operations section of this report contains a recommendation on field operator rounds. Interviews were held with Field operators and other staff to request feedback on training and their program evaluations. All were positive and the interviewees indicated they were comfortable with the mechanism of providing feedback to the training department.

2.5. MAINTENANCE PERSONNEL

Eighty per cent (80%) of the Tricastin NPP maintenance training is provided at the site and at the Gurcy training centre. Maintenance personnel training which includes the I&C functions as well as mechanical and maintenance, is skills based and includes an established task analysis and is structured as with the other training.

The training

ups and instructors. As with other departments the PTF is developed and reviewed by the employee with his manager. All programs and records are maintained within the specific departments by a training representative and owned by the Department head. The training files include the yearly plan, completed training, nuclear safety work classifications and the yearly plan that had been established by the employee and his manager. The CIF not only ensures a well documented training plan but also confirms the level of safety authorization (nuclear safety level of plant systems work) for the employee. Future training is then scheduled with the site training department. The system of defining training objectives derived from the task analysis and based on competencies and skills is complete for the maintenance and I&C departments. This program effectively ties into the PTF and the forms are available in the employee files. New recruits are covered by the same process and assigned a shadow trainer who provides a thorough experience transfer from the experienced trainer to the trainee and allows for continuous progress reviews.

Contractors are closely monitored by an assigned controller who works with an individual assigned from industrial relations to monitor and evaluate effectiveness and implementation of contracts requirements. Audits are performed on the contracted company and feedback from the plant and department determines their continued work.

Refresher training is also monitored and maintained in the same manner within the maintenance and I&C departments.

2.6. TECHNICAL SUPPORT PERSONNEL

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

Shadow training is utilized and a PTF developed for each employee which provides tracking for safety authorization as with the other departments.

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

2.7 MANAGEMENT PERSONNEL

Management program training includes skills based on feedback from personnel appraisals and management issues derived from corporate task analysis and is provided by internal and external experts. Training and program development was reviewed at different levels. The program may last several months but is not developed for one time continuous training but over a longer period. As with other training functions, managers within EDF and Tricastin NPP as well as within the promotion line in operations are reviewed during the performance appraisal function for future training. Competencies are evaluated to ensure they are in agreement with the companies goals, objectives and policies. The operations competencies for shift supervisor and shift operations manager are, for example, developed focusing on management skills and strong review panels that challenge the candidate as he/she progresses through the organization. They provide a method that is part of a structured selection process. This review and training also focuses on identifying the appropriate attitude and safety perspective of the candidate. All management positions are reviewed against established expectations for the potential candidate and are based on assessed competencies. Another support function in choosing competent managers is an aggressive recruitment program that is well structured and focused on specific replacement for staff leaving or potentially leaving the NPP.

The program focuses on general management skills, such as leadership, communications, project management and coaching. A CIF is also maintained for nuclear safety authorization tracking.

Human factors training was observed and reviewed. It is utilized as part of the process to incorporate the human factors program into the plant reviews of events.

2.8. GENERAL EMPLOYEE TRAINING

General employee training is developed based on tasks and is of good quality and is provided as a refresher routinely every two (2) years. The initial training and refresher courses are in line with IAEA safety standards and based on good international practices.

Many staff participate in the training and the part time trainers are involved for specific tasks. The training includes quality assurance, radiation protection, fire fighting, industrial safety and regulations and guidelines. Although the training is well prepared some industrial safety practices are not implemented effectively and therefore a suggestion has been made to consider developing photos or a video to be used with management and plant staff that demonstrates expected plant conditions and expected management involvement.

For employees who have an emergency response role it was noted that refresher programs are provided more routinely.

DETAILED TRAINING AND QUALIFICATION FINDINGS

2.1(1) Issue: The system of recording training data does not provide specific guidance for tracking trainining attendance routinely versus annually.

Individual training files are stored within departments. The files contain information on codified corporate courses, site-codified courses, site non-codified courses, shadow training and individual qualifications. The information is contained in a computer system within the training department and on paper in each department. The computerized database system contains information on corporate and site-codified courses.

The training section and the training representatives of the departments are involved in updating this system. The updated printout is however not filed in the individual training record except to verify attendance of an employee. The training records in the department are considered the official records but are only updated as required in the procedure on an annual basis.

Examples: During discussions focused on the topic of attendance some records were made available for employees in the QA department and although the files were completed within the employee training plan and materials, the actual attendance at course is determined by the computerized database in the training department.

It was determined through discussions that all department records would be in the same state of incomplete data on attendance during the year and that each manager could check the computer records in training for verification and completion. This could possibly result in a training file not having up to date information.

Without specific guidance for tracking training attendance information, required training attendance could be missed.

Suggestion: Consideration should be given to review the system of recording training data to ensure that a comprehensive and consistant approach is maintained. The plant should consider which system is best suited to comprehensively track training attendance and proceduralize this system to ensure consistent tracking.

2.1(a) Good practice: Since 1992, Tricastin NPP has been implementing a program of trainer support to the NPP identified as the “ Club des Formateurs à Temps Partiel “ or the Part Time Trainers Club. This group of individuals is specially chosen from volunteers, provides training for all the training departments at the site, which allows the trainers to share their plant technical knowledge and experience. This program also provides a mechanism for strong operating experience feedback. There are currently seventy-six (76) part-time trainers in the club coming from all the departments within Tricastin NPP. They cover the fields of nuclear safety, first aid, environment, emergency plan, radiation protection, information systems and fire fighting. A “ club “ coordinator within the training manages the scheduling of the part time trainers, relations with the managers and training skills development. Although many personnel volunteer for the program only those demonstrating the appropriate skills and attitudes are chosen. The part time trainers use their training skills to enhance their career development at Tricastin NPP as possible future managers and supervisors, future full time instructors, future experts and advisors. In the year of 2001 three hundred and eighty (380) man days of training was provided to the training departments at the plant. The program is controlled, proceduralized, monitored and assessed on a routine basis to ensure the highest level of implementation. Each trainer has a personnel file maintained within the department and evaluations are performed. Plant management supports the program and as mentioned above this provides many days of training for plant staff through the use of their staff. At the present time this program is specifically implemented at Tricastin.

2.1(b) **Good Practice:** Since the Tricastin NPP has focused their attention on the improvement of training and established and implemented a monitored action plan, multiple methods are in use to ensure skills attached to tasks are met and maintained. During the review process it was noted that the maintenance of job functions are not based entirely on traditional type training courses. A specific policy implemented in Tricastin NPP is to offer a variety of methods to trainees to maintain their skills and competencies. The plant supports its new recruits with a formalised tutoring and shadow training program based on trained tutors and shadow training booklets. Immersion programs are proposed and implemented to improve cross-functional experience and skills. A project-based training method has been developed where there is theory input followed by the development of a project for each trainee to develop and implement based on course work completed. This project is then presented, discussed and assessed by the training centre and management. Situational team training is then used for practising action sheets for all field staff. The strength of this system lies in the fact that team management follows the field staff and completes observation sheets during the training. Afterwards well constructed debriefing sessions use methods of active trainee participation to prod and encourage response focused toward improvement. Newly appointed managers are provided with coaching to ensure they are able to perform the oversight function of this process. As a part of this program the operational departments monitor infrequently performed and other unusual activities so that these skills are constantly maintained by task assignment rotation and by including the tasks into scenarios for simulator training. The networks set up for key functions such as human factor specialists, contractor monitoring supervisors and team leaders enable the participants to identify training needs, share their experience, brainstorm and solve problems.

2.7 MANAGEMENT PERSONNEL

2.7(1) **Issue:** Management involvement in the field does not motivate employees sufficiently to compel them to adhere to management expectations, policies and standards in their everyday work. During the walk downs and plant tours the team observed that in many cases, high industrial safety standards are not practiced in the plant. The team observed the following:

1. The refresher courses on industrial safety and radiation protection are of good quality.

However, the team observed that in many areas of all four units plant staff did not comply with the training provided as a routine part of normal daily work.

2. There is a lack of rigor applied to the industrial safety standards such as wearing of hard hats, ear protection, smoking in restricted areas , closing of fire doors and management involvement when these issues are observed.
3. Management personnel are not aggressive in identifying and coaching staff when observations are made in the field of industrial safety non compliances. (see issue 1.2(2) and 1.5(1)).
4. Performance standards and principles are not being consistently applied in the field for routine execution of work.

Although managers are present at the opening and during the evaluation of various training courses, and the training programs appear to implement the necessary tasks and objectives to advocate expectations and set standards, performance does not meet the training provided.

Without a strong commitment to adhere to industrial safety and radiation protection rules, improvements in the field will not be reached.

Suggestion: The plant should consider that in addition to existing managerial measures for areas needing performance improvement such as industrial safety and radiation protection, all the managers should take an active part in reinforcing the expectations set by the plant manager. The team suggests that the plant consider developing and using site specific tools (pictures and videos of actual and ideal conditions at Tricastin NPP) to reinforce their commitment to helping their staff continue to improve adherence to plant expectations in these areas. These aids would reinforce management's need to intervene with employees when non-compliances are observed to coach and encourage adherence .

3. OPERATIONS

3.1. ORGANIZATION AND FUNCTIONS

The operation department is managed and staffed by well-qualified engineers, professionals and technicians. In order to strengthen the attitudes of the staff and communicate their central role the operation department has developed the document "Operation Nuclear Safety Requirements" and conveyed the content to the other departments. The team has assessed this as performance improvement.

The operations department for all four units at Tricastin NPP has adequate staff. Seven shift-teams per twin-unit are responsible for real-time operation. Each shift team has 1 shift operation manager, 1 shift supervisor, 1 tagging supervisor, at least 4 control room operators and 5 field staff (field technicians and field operators). The shift schedule is designed so as not to have more than three night shifts in row, including training and vacation time.

The role of the off-shift organization structure is to support the on-shift structure in the areas of expert appraisal and operator experience feedback, coordination of short shut-downs, planning and coordination of refuelling outages, planning of medium-term activities and on-line technical support.

The off-shift organization is divided into three groups: Technical Support, Methods Branch and Training.

The cross-functional "Power Operations Project" is partly staffed by members of the Operations department, but also includes personnel from the Coordination department, the Safety and Quality Advisory Unit, Chemistry, Mechanical Maintenance, I and C and Electrical maintenance, Industrial Safety, Radiation Protection, Nuclear Logistics and the Modifications team. This team produces an effective daily graphical time plan which provides the control room with information on activities such as surveillance tests and other significant occurrences scheduled during the shift.

Another important cross-functional team is that of the "Outage Project". This team is responsible for scheduling and planning outages on all units.

3.2 OPERATIONS FACILITIES AND OPERATOR AIDS

Each unit has a main control room and emergency shutdown panel. The unit 1 and 2 control rooms are adjacent, separated by a meeting room. The same layout exists for units 3 and 4. They are well equipped, well located and use displays which include mimics and annunciator alarm panels. Access is well controlled. However, the plant may consider developing the plant computer so that the unit's key parameters can be displayed together and can be seen from all parts of the control room. The annunciators are equipped with diode lamps (LED's) to avoid reflection of lights and difficulties when changing them. The number of active annunciators is low. Tricastin's goal is zero annunciators lit. Tricastin NPP has implemented a program to identify deficiencies and correct them. This is now underway and good results have been achieved on units 1 and 2. However greater efforts are required to bring units 3 and 4 up to or above the standard of units 1 and 2. In this regard, housekeeping in external areas is good and in the plant generally was acceptable. However there were some areas in units 3 and 4 and away from the normal tours area that should be maintained at a higher level of cleanliness. The team provided a recommendation in this area.

The team recognized need of improving plant labeling and recommended Tricastin NPP to strengthening their labeling program.

Line-ups for work or for other reasons are well managed by the tagging supervisor with support from the shift-team and Power Operations Project. However information provided to the control room operators about locally operated equipment can be improved and the team has made a suggestion on this subject.

The nuclear safety time-plan (Diagramme Pédagogique Sûreté) is a very good idea. This safety plan is fixed 90 days prior to the start of outage. It has a well-designed layout. In addition to time-lines and reactor modes, it also displays reactor system level, main work activities, and the extent to which systems can made unavailable.

3.3 OPERATING RULES AND PROCEDURES

The operating rules are generally presented in technical specifications for operation, incident and accident procedures, monitoring and surveillance test programs for equipment and safety-related programs. Main operation procedures are developed based on the technical specification limits. Surveillance programmes are documented and all information analysed by the operations department.

Operating procedures are in good condition, clearly written, well understood and provide the necessary references. The system for procedure updating works efficiently. There is a well-organized system developed for operators to report all operation procedure errors. In the event of any modification to operation, a temporary operating instruction is provided to take into account any deviation from the operation document. Flow sheets and emergency procedures are encased in plastic and carry coloured information.

Emergency procedures are symptom based. They are of a high standard, are clearly understood and are easily accessible. When a deviation occurs, an alarm gives operators reference to the right procedure. Operators can easily and quickly find the procedure.
The logistic branch performs procedure updating, and their main tasks are:

- Incorporate the corrections to operating documents (procedures, alarm response sheets and surveillance tests),
- Draw up and validate the fire action sheets,
- Prepare for the integration of modification files sent by other departments,
  Two Shift Supervisors are at the head of this branch:
- One Shift Supervisor updates and supervises the operations department documentation,
- One Shift Supervisor supervises and analyses the documentation of the modifications to be integrated, either with the unit shut down or in operation.

They are assisted by staff seconded from the shift teams and by permanent staff.

It is very important for operators to report and for managers and authors to review procedures after data has been filled in, in order to correct deviations to support improvement of human factors and correctness in documents used for operation.

3.4 OPERATING HISTORY

The plant has implemented a long-term operations data and history program for improving the safety and reliability and monitoring of the effectiveness of operations. The system contains the most important indicators, although in the technical support section of the report, the team issued a recommendation concerning the analysis of events associated with work site activities.

Operating experience feed back is sent to operations personnel on the shift and is part of the operation managers responsibilities. If necessary, lectures are used to transmit the most important operating experience. An electronic mail system is used for rapid experience feed-back (REX)

In the technical support section of the report, the team provided a suggestion about the threshold for reporting “low” level events. Reporting and analysing these low-level events is essential in identifying precursors that could be used to prevent events and improve training.

3.5 CONDUCT OF OPERATIONS

The control room gives the impression of professionalism. Operating procedures are available in the control room and are used.

Shift turnovers of control room personnel were observed to be detailed, professional and of high quality. The briefings following the turnovers are adequate to assure the information exchange within each shift crew is of high quality. During debriefing and shift turnovers the communication pertaining to the unavailability of safety related equipment is given priority.

Operations personal do not use three-way communication, STAR (Stop, Think, Act, Review) techniques or use of the phonetic alphabet when communicating or performing field actions. The team encourages that the plant review these practices.

The surveillance program adequately verifies the availability of safety equipment.

Field operator rounds are supported by special portable computers which are good tools to record, compare and submit important plant parameters. However, the observed round was focused on the parameters required by the computer and was not attentive to material condition, industrial safety and fire protection deficiencies. The team recommends improvements in the observational skills of field operators and better coaching by supervisors and managers.

A successful cross-functional group is the Technical Effluent working group (GTE). The site has a very effective program for minimizing liquid effluent releases and the team has recognized a good practice in this area.

3.6 WORK AUTHORIZATIONS

The plant system for work authorization is well organized. A person that detects a deficiency reports it using SYGMA, a corporate application designed for maintenance work management. Four daily cross-site meetings, with managers involved, give a broad understanding between departments of how work is prioritised. These meetings are:

a) Diagnostic meeting.

The participants are the shift supervisor, two I & C and electrical technicians and one mechanic. This meeting is held every morning and the purpose of the meeting is to process the various work requests issued since the last working day so as to make a prompt diagnosis of the various defects identified and to rectify these if possible.

b) Daily meeting at 8 am.

The participants are the shift operations managers, the associate directors and the power operations project supervisor. The shift operations managers present an assessment of the units' status and any problems encountered.

c) Daily meeting at 11 am.

The participants are the members of the power operations project team, including safety engineers. The following subjects are dealt with:

- Examination of the various work requests issued by the operations department and validation of the ranking of priorities.
- Discussion of the other work requests considered as important.
- Assessment of the diagnoses requested.

d) Daily meeting at 3 pm

The participants are the members of the power operations project team. The meeting deals with the following topics:

- Progress made with work.
- Issuing of the work for the next day based on the schedule.

The participation of the shift operations manager and nuclear safety engineer ensure that nuclear safety is considered.

Each shift has an experienced tagging supervisor whose main responsibility is to carry out tagging activities and real-time monitoring to support the shift supervisor. The system used for control of temporary modifications and maintenance work is generally good. However, the team made a suggestion about the length of time temporary modifications are allowed to be installed in the technical support section of the report.

For each post-maintenance test, a "requalification record sheet" is produced, defining all verification measures to be performed and ensuring their traceability. The post-maintenance test is performed in two stages: component and system requalification, respectively. Component requalification is performed by the maintenance department and system requalification by the operations department and approved by the shift operations manager.

The requalification record sheet is incorporated into the work request system which makes it possible, even during an outage, to keep a record of these sheets and thereby ensure the operability of components and systems after maintenance work. Operations are incorporated into the site outage project team program.

The main tasks of operations during outage are to guarantee:

- Plant safety through maintaining the availability of equipment required, depending on plant reactor mode.
- Industrial safety of the maintenance workers through tagging out equipment, stipulating the risks occurring, especially if the tag-out is not consistent with the defensive measures set up.
- Adherence to the deadlines in the schedule for the activities for which they are responsible.
- Operating the systems in operation.

During an outage, the activities are manifold and often carried out in parallel. In order to facilitate this management an outage organisation is set up. The outage project manages all unit outages.

An operations outage team is set up and is responsible for the scheduling of operations activities incorporating the debriefing reviews for nuclear safety, industrial safety and the schedule. It coordinates the interface between operations and maintenance in real time for all activities involving operations.

3.7 FIRE PROTECTION PROGRAMME

The Tricastin NPP fire protection program follows most international industrial practices. Fire detection relies on a modern fire alarm system.

Actions rely on three organizational response teams. The “first line response team”, staffed by members from the shift teams, is sent out to verify the fire location and isolate the affected fire zone. They get fire protection formal sheets (FAI) directly from the local alarm panel area.

The “second line response team” then prepares for and begins fire fighting.

The third team is the external fire-fighting brigade.

The OSART team observed a fire drill, and found good professional skills but has made a recommendation that the plant should take actions so that fire response times meet industry expectations and best practices.

The team also reviewed fire loading and has made a recommendation to reduce the amount of flammable material in the plant. The plant arrangements to facilitate escape from areas with smoke are above the doors of the plant. These signs may be obscured during a fire and the team has therefore recommended improvements.

3.8 ACCIDENT MANAGEMENT

Accident management is well organized and provides a good response. Roles and responsibilities during emergencies are clearly defined within the operations department.

The operations staff is trained to respond to an accident during simulator training, which includes special emergency training. In an event, the shift operations manager controls operations from the local command post in the main control room. The safety engineer and shift supervisor monitor the unit from the control room. The shift operations manager, as head of the installation, communicates with plant management.

DETAILED OPERATIONS FINDINGS

3.2 OPERATIONS FACILITIES AND OPERATOR AIDS

3.2(1) Issue: Housekeeping practices in units 3 and 4 are below IAEA safety standards and good international practices. Although some deficiencies exist in all units, sufficient standards have been reached in units 1 and 2, but units 3 and 4 are below these standards. The team observed the following deficiencies;

- Dust in the switchgear panels 2LHA, 2LHB, 2LLI.
- Wood and cardboard boxes in turbine floor.
- Wood and garbage below the compressors room in units 1and 2.
- Oil leakage in Emergency Diesel Generators (EGD's) of unit 2.
- Equipment SRI systems unit 3 very dirty with oil.
- Supply electrical cable not well protected in a pass zone.
- Paint in nuclear area on floor and walls in bad condition with scratches that make it difficult to carry out decontamination works (unit3).
- Heavy material not attached in room of 4RCV001PO, this material could become a missile over a safety related equipment in a seismic incident.
- Dust in electrical panels in unit 4 especially in the upper covers.
- Wooden ladders non-fire coated in fuel building in Unit 4.
- Poor lightning in the room of the spray pump 3EAS001PO.
- A can of lubricant trademark MOLYKOTE was left on the equipment DEG101GF.
- Chilled Water Pump. Handwritten identification in equipment DEG013VD.
- Poor lighting in the room of the equipment DEG101GF.

Poor housekeeping can cause damage to safety equipment, to the personnel and can cause fires.

Recommendation: The plant should continue its efforts to improve housekeeping particularly in units 3 and 4, to international standards and practices.

3.2(2) Issue: The plant labeling program does not meet best international practice or IAEA Safety Standard guidance. The plant labeling program has encouraged inconsistencies which have caused wrong, missing, incomplete, unapproved and deteriorated labels.

Some deficiencies in the four UNITS were noticed during plant tours. Examples of the types of deficiencies that were observed are the following:

- Lack of labeling in pumps 0DEB901PO and ODEB902PO.
- Hand written identification in breakers 1RPE006PS, 1RPE00PS8, 1RPE010PS, 1RPE025PO and 1RPE028PO, 2DEG305VD.

- Hand written identification in breakers 3LKH507, 3LKH508, 3LKH509, 3LKH510, 3LKH511, 3LKH028, 3LKH511, 3LKH609 and 3LKH610.
- Demineralized water tanks: 8SED001BA, 9SED001BA identified with small labels.
- Old labels from the construction phase.
- Warning signs difficult to read on "Fyrquel"-tanks.
- Hand written identification in the following equipment and instruments: 4RCV38VP, 4RCV37VP, 8DVN269VA, 3RIS91VP and 3RCP003PO.
- Hand written identification “CEX003MO TN3” placed at TN4 and in operation.
- No label in following equipment: 3DSRO22CR, and no label on valve, below 3ACO001PO.

Unauthorized and uncontrolled labeling increase the risk for human errors and can cause damage to the equipment and personnel.

Recommendation: The plant-labeling program should be strengthened to achieve a higher standard of labeling that meets best international practice and IAEA safety standard guidance.

3.2(3) **Issue:** The status of all uncommon equipment line-ups is not clearly displayed in one location. The team observed several locations for these line-ups;

- Written pattern is available in the tagging office near by the control room.
- Tagging supervisor does line-ups. He informs operators.
- Information about work permissive line-ups is available in administrative computer facility in main control room.

Lack of visual aid clearly displayed in one location, to guarantee awareness of the status of locally operated and blocked equipment and uncommon line-ups could impede the operator's ability to take the right decision and actions when the plant is in a transient situation.

Suggestion: The plant should consider displaying the status of all uncommon equipment lineups in one location. Other plants have successfully implanted a type of computerized system that displays the status of safety systems.

3.5 CONDUCT OF OPERATIONS

3.5(1) **Issue:** Field Operators fail to recognize some deficiencies and supervisors and managers don’t coach them to reinforce expected high standards for inspections during their plant tours.

During a plant walkthrough, with a field operator in the compressor room of Unit # 1, the field operator did not find pieces of wood, cans, a pipe from the construction phase and garbage under the compressors and no deficiency report was issued. The field operator performed his tour very rapidly.

Other deficiencies that were not recognized by the field operators include:

- Corrosion in compressor in Unit 2, 0 DEB 902 PO and 0 DEB 901 PO, 1 SEC 007 PO, 0XCA002PO, 4SEG027VE, 4RRI031VN, 4RRI003RF, 4RRI002RF, 4SEC028VE, 4RRI004RF and 4RRI032VN.
- High vibration in tubing of the equipment 2GPV175YP. Instrument 2GSS300ZZ.
- High vibration in the actuator of the governor valve 2GPV024VV.
- Loose covers, lack of identification, loose screws on 0DEB901PO and 0DEB902PO.
- Damaged Insulation in pump 2DEG007PO.
- Leakage in OXAA002YG, 0DEB902PO, 0DEB901PO, 4RCV001PO, 4SIT017MG, 4CTA006PO and 4APP139VL.
- Damage in the insulation of cables 4GST.
- Oil leakage in 4RCV003PO, 4SAP001CO, Emergency Diesel Generators (EDG's) in Unit 2.
- Dirty emergency batteries 4LBC001BT (located in room W343) and 4LCA001BT (located in room W342).
- Internal leakage through 4ARE302VL to drain collector. Steam spreading in drain header to other drain collectors.

Inadequate inspection activities and low standards for inspection may result in unresolved safety and operability deficiencies.

Recommendation: The plant should develop a program to improve the ability of field operators to recognize deficiencies and re-enforce the expectation of managers to coach field operators on high inspection standards.

3.5(a) Good Practice: The site has a very effective program for minimizing liquid effluent releases. The operations department has been a driving force behind a site program for minimizing liquid effluent releases. It was observed by the team that Tricastin NPP has moved from a very poor position among other EDF plants to the third best position. The amount of released liquid effluents has dropped from 5.5 GBq (1990) to 1.5 GBq (2001). At the end of 2001, the release rates were less than 50.0 MBq/month. Tricastin's goal is to become ISO 14001 certified by 2003 and this accomplishment will help achieve this aim.

Site management has emphasized the involvement of all plant stakeholders in this initiative. An effluents team, consisting of seconded technicians from the operations, chemistry, radiation protection and maintenance departments, has been formed and manages the overall program. This methodical involvement of seconded technicians from all of the departments that can influence either the production or processing of effluents has been the single most influential factor to the success of this initiative. Most notably, the auxiliary operators from the Operations department have assumed a personal ownership for and commitment to the success of this initiative. They have become the driving force in the results that have been achieved.

First, the auxiliary operators have dealt with the production pathways for liquid effluents. They have worked with the reactive maintenance team to identify and eliminate the sources of liquid effluents (e.g., primary coolant leaks). Their success can be measured by the fact that over the past 2 years, the input volume has been decreased by 90%.

Second, on a daily basis the auxiliary technicians record the volumes in the various tanks. They then enter this data into a dedicated effluent computer application (TEU), developed by the plant. This application, allows for the accurate tracking of the activity and volumes of all liquids in storage. More importantly, it provides the means to segregate longer lived radionuclides, such as Co-60, thereby minimizing the cross-contamination of tanks and the associated increased releases that would occur.

A third improvement has been the addition of a special filter to trap AG110m. This improvement was made as a continuing improvement effort, possible once the initially high release rates had been remedied.

Finally, the program has been assisted by the categorization of liquid effluents into four "families." This simple categorization enables all levels of the staff to appreciate the importance of reducing liquid radioactive waste quantities and to understand how best to dispose of them.

3.7 FIRE PROTECTION PROGRAMME.

3.7(1) **Issue:** Fire response times that are demonstrated during exercises were observed to be unusually long.

In a fire fighting exercise, the response of the on-shift team was delayed. The communication to the offsite fire brigade caused delay in its response. Debriefing by plant personnel identified the reasons for the delays.

Undue delay of fire fighting can cause a significant threat to the safety of the plant.

Recommendation: The plant should assure that the fire response times are adequate. The plant is recommended to review and improve the fire fighting arrangements and performances to assure that after an automatic fire alarm in the control room is received, the fire fighting by on site or off site fire fighters can be assured in a reasonably short time.

3.7(2) **Issue:** Transient fire loading in all plant areas is not fully controlled.

Examples of transient fire load found by the team are:

– Some wood stored in Unit 1 between floors.

– A lot of wood and cardboard boxes inside the plant especially in the turbine floor.

– Use of wood in Radiation Control Area for scaffold support.

- Accumulation of inflammable materials (wood, paper, etc) in turbine building.
- Wood is used in the reactor building (of Unit 3 during the outage and the turbine hall).
- Wood was stored in unit 1 near tank 1 JPT 051 BA.
- Dust in the switchgear panels 2LHA, 2LHB, 2LLI.
- Wood and cardboard boxes in turbine floor units 1 and 2.
- Wood and garbage below the compressors room in units 1and 2.
- Oil leakage from emergency diesel generator A and B of unit 2.
- There was an open barrel of oil on the turbine floor between units 2 and 3. Cigarette butts were found in a drain a few meters away.
- Significant oil leaks in the RCA around the unit 4 charging pumps.
- In the pump rooms of unit 1 no deficiency tags were observed for small oil leaks, which raises the question as to whether tags should have been used.
- Equipment SRI system Unit 3 very dirties with oil and supply electrical cable no well protected in a pass zone.
- Oil leakage in EDG's (LHP/LHQ) of unit 2.

Flammable material increases the risk and consequences of fire.

Recommendation: The plant should establish and implement a policy regarding the transient fire load in the plant. This policy should be re-inforced during periodic training activities.

3.7.(3) Issue: Emergency exit pathways and signs are not sufficiently observable during high smoke and steam conditions. Emergency exit lighted signs are placed above doors where smoke could hide them during a fire.

With poorly marked escape routes, personnel could experience difficulty finding emergency exits during fire or steam leaks.

Recommendation: The plant should take measures to facilitate escape from areas during a fire. Some facilities use fluorescent paint to mark escape routes.

4. MAINTENANCE

4.1. ORGANIZATION AND FUNCTIONS

Maintenance responsibilities are shared between a mechanical maintenance department comprising about 193 persons and a department combining I and C, electricity and industrial data processing of about 172 staff. Other maintenance services such as housekeeping, scaffolding and warehousing are provided by other departments. A separate project-based structure is established to manage outages and power operations. All the department heads report directly to the plant manager.

While this is not the typical organization seen in the industry, roles, responsibilities and goals for each department are clearly defined and understood via a memo (contract) between the plant manager and direct reports. Each department however, operates in an independent way converting policy to practice, each having their own tools and developing their own programs from common policy. During the past 3 years the maintenance department has set up a process to tighten their management by applying similar procedures in both organizations and to improve easy communications between their teams. Additionally a series of cross-functional processes such as the “power operations team”, “outage project” and the “Top Ten” policies appear to apply the necessary plant integrating factors. The integrated set of cross-functional meetings known as the “power operations team”, includes a combination of the various processes, information dissemination and meeting activities which make this application very useful to manage daily activities.

The management appears adequate to control the maintenance backlog which in the past 5 years was reduced by one third with the average delay also being reduced, through the improvement of work preparation quality with safety, industrial safety and radiation exposure analysis assessed at the same time.

A large part of maintenance work is subcontracted, especially for outages. To correctly monitor contractor activities, the maintenance departments have trained a motivated team to monitor from the beginning until the end of their work, calibration of tools and testing equipment, safety, industrial safety and ALARA criteria according to contract terms with special care in technical proficiency during the execution of the work by the contractor. The way the contractor relationship is handled by the plant includes developing good contractor skills and a focus on improving plant performance and is considered as a good practice. At corporate level this practice has been highlighted as a good approach.

In each department, a methods branch composed of job planners with a technical background is responsible for the introduction and adaptation of all the modifications required in site maintenance programs and procedures, that includes changes in corporate maintenance programs, Safety Authorities requirements and Operating Experience feedback. These teams are very proficient and produce a very consistent Maintenance Package for execution.

Work packages are prepared and include all the risk analysis, procedures, requalification tests, materials and resources for a complete documentation. This provides the structure for work teams to work with as few unplanned occurrences as possible and good documentation.

The plant has several databases used by maintenance. The computerized work management system SYGMA, software developed for all the French nuclear power plants, is the major maintenance management tool. Based on SYGMA data and established communication channels, corporate departments have an enormous amount of information, including operating experience feedback with the information coming from all similar plants.

A major strength is the corporate ability to provide, on a real time basis, maintenance experience, and equipment to all its plants.

The tagging system is not integrated in SYGMA, but is implemented with other programs by the operations department. The integration of these activities as a module of SYGMA would improve interfaces between the Maintenance and Operations departments. Additionally, the introduction of the concepts of workflow or bar-coded documents computerised management systems would improve the reliability and speed of the process.

4.2. MAINTENANCE FACILITIES AND EQUIPMENT

Each of the maintenance areas has well equipped workshops with good standards. There are also workshops in radiologically controlled areas.

Tool storage has good controls to prevent damaged equipment from being reissued. Special fireproof cabinets were available for the storage of chemicals and flammables.

Mechanical maintenance uses a bar coding system to link tools to people and jobs. Electrical maintenance has a warehouse with an effective system to properly manage and track calibration equipment with adequate procedures.

Calibration of measuring instruments and tools are performed on a regular basis by contractors. For items which require regular checking, such as torque wrenches and some measuring instruments, a calibration verification capability is maintained within the applicable maintenance section. Calibration records are up to date and complete.

Training facilities and mock-ups are available for major maintenance activities.

Lifting equipment is normally tested annually by a qualified contractor and mechanical warehouse equipment labelled with the year of authorised use with a coloured plastic ring for easy identification. Slings and hooks from the plant have bar-coded identification labels that differentiates them from the equipment supplied by contractors. Contractors are required by contract to supply certification of their slings and tools but at the moment is difficult to identify this material in the field.

Tools for use in controlled areas are stored in a storage room and are not used outside the RCA. When a tool or item of equipment is taken out, it follows a specific procedure.

There is a specific storage area for oils; however improvements should be made to identify the oils issued, in order to comply with the ISO14001 standard that will be part of the objectives of the plant for next year.

There is also a steel warehouse where carbon steel and stainless steel are clearly identified.

Temporary installations (TI) are managed according to a procedure defining the installation process. To implement regular TI, the mechanical department has set up small storage areas in the field for each Unit and the areas with materials required for every TI clearly identified and installed in the installation with adequate connections. The electrical department has two specific storage rooms, one for cabinets and instrumentation devices and another for grounding equipment. Through this enhanced practise, the installation and management of TI is made quicker and easier.

4.3. MAINTENANCE PROGRAMS

The plant has a well-defined preventive maintenance (PM) program commensurate with the importance of the equipment. The program used throughout EDF is based on internal and international experience. The site adds its own specifics for non-safety related systems and complies with corporate requirements for safety-related components. The Plant has improved dramatically since changing its PM program over to a Reliability Centred Maintenance program (RCM). Predictive maintenance techniques such as vibration monitoring, valve diagnostics, thermo-graphics and oil analysis are all utilized to adjust the PM program and some of them are used to inform the head office and other plants of results.

The overall In-Service Inspection (ISI) program is clearly defined for safety related systems by head office and the plants program and perform the work to an agreed schedule. There is a comprehensive process for handling deviations with considerable expert advice available from corporate resources.

The corrective maintenance program appears to be efficient with a well-managed work control system in place. All work requests, deviations and maintenance records are stored on the SYGMA system and accessible to all personnel with a need at the plant. The identification of deficiencies, out of tolerance results, safety-related events or low-level defects are managed using a specific module of SYGMA called “discrepancy processing” (Traitement des écarts).

4.4. PROCEDURES, RECORDS AND HISTORIES

Every maintenance task at the plant has a work order that contains, when appropriate, nuclear or industrial safety risk analysis, procedures to be applied or hand written instructions, tagging documents, results and a history of the job. In general such packages are well managed and compiled, but some of them could be improved.

The documented history of the plant is available in a main document control system and satellite centres. Documentation is well controlled and easy access is available by computer.

Maintenance documents reflect safety culture principles, including policies on procedure quality, procedure compliance, self-checking and the requirement to stop work if the worker is in doubt.

4.5. CONDUCT OF MAINTENANCE WORK

Overall, maintenance is performed conscientiously and professionally by staff well trained in their specialised skills. Procedures are followed and in most cases, deviations diligently reported. There are however some specific maintenance and support activities areas where observed standards need improvement. For example improved standards in personnel safety and radiation protection, storage of material and job site conditions postings would be appropriate. In addition a clear policy should be enforced to ensure that the worksite is left tidy after maintenance works have been completed in areas where safety related components are installed. A strengthening of performance and management oversight in these areas is recommended. In particular improvements to foreign material exclusion practices in the spent fuel area, reactor cavity and in general when circuits and main components are open. The team made a recommendation in this area.

An improvement program has been implemented for maintenance management staff to be present in the field demonstrating high standards, monitoring job performance, reviewing safety conditions and equipment status, during plant operations and during outages. This practise is considered as a good practice. But in several areas, a need for improvement was observed in terms of industrial safety and radiation protection standards, as well as the identification of low-level plant and equipment deficiencies.

Significant operating events are analysed in depth with a clear assignment of responsibilities and actions which are effectively monitored. Personnel involved in the event take part in the analysis process and results are made available to the plant. This remarkable participation of staff allows the use of event analysis as a good tool to spread safety culture.

4.6. MATERIAL CONDITIONS

The material condition is good in units 1 and 2, but requires many improvements in units 3 and 4; in particular the turbine hall and auxiliary building BAN08. Degraded surfaces on floors and walls, inadequate lighting, poor condition of paintwork on equipment, thermal insulation degradation, smaller pumps and auxiliary systems insufficiently maintained and some equipment showing degraded aspects were noted in units 3 and 4. The degradation process trend is dynamic and could affect in the short term other equipment important for availability or safety. It is difficult to maintain good standards of works forgetting material conditions around the plant.

The team recommended the Plant to improve the condition of units 3 and 4 and bring it to at least the same level of material condition as units 1 and 2 as soon as possible.

4.7. WORK CONTROL

Two different projects “Power operations” and “Unit on Outage” have been set up to control and coordinate all the activities. Three daily meetings with a quick and effective process brings together the various departments involved in getting work done on the different projects and enables them to work together in a well disciplined manner.

The work prioritisation process and the work control system are taking material and manpower considerations into account and designating achievable timelines. All the activities are prioritised and problems are discussed for general information and decision-making.

All activities are scheduled, corrective maintenance works are incorporated every day and the progress of activities is integrated daily in the planning tools to provide detailed information. Specific actions are implemented when problems occur during an activity, and these actions are followed in the coordination meeting.

At the execution level, two daily meetings in each department give general information about the units status. An effective work distribution and quick information about problems affecting works in progress provide a diligent feedback to the project management.

The organization is very heavy and a lot of different participants are involved in work execution. But the projects organization, with a cross-functional vision, maintains an adequate control and coordination in unit activities.

4.8. SPARES PARTS AND MATERIALS

The plant has a main warehouse to manage all the concerning receiving and dispatching activities, quality assurance packages, stock control taking into account all the requirements in terms of storage and shelf life. The warehouse also prepares packages of parts that are supplied to the work team perfectly packed, just in time during normal operation and especially in outages works.

All spare parts are accurately identified and properly packaged. The packaging material is renewed according to a shelf life program.

A high level of quality is found in this area and the warehouse management, with its closed loop material supply process should be considered as a good practice.

4.9. OUTAGE MANAGEMENT

Outage management is performed well according to a long-term plan developed by the head office and the plant. Dedicated resources and a strong management team have been developed with considerable project management expertise. A managed process with structured meetings has been developed to keep tight control of outage activities and a quick response to deviations. Detailed planning and work package preparation starts six months before an outage and changes are frozen four months later. Nuclear and industrial safety experts are part of the team and pay special attention to planning and maintaining adequate assurance of safety margins throughout the outage stages. An outage execution team is assembled from experienced people on the running units starting six months before the outage. From the time of their secondment to the end of the outage they are dedicated to outage work. Three types of outages are defined: a simple refuelling outage lasting about 35 days, a normal maintenance outage about 45, or a ten-yearly outage which duration varies according to the package of modifications required.

The planning tools based in OPX2 software and related applications give to the project management the information required to ensure a full perspective and details to make the right decisions. Additionally, the operating experience feedback is incorporated, and simulations and forecasts can be drawn up for the long term planning.

DETAILED MAINTENANCE FINDINGS

4.5. CONDUCT OF MAINTENANCE WORK

4.5(1) Issue: The plant policy to avoid introduction of foreign materials in equipment and pipes is not effective. The control of the plants foreign material exclusion (FME) program was weak in several areas of the plant.

- The team found numerous examples of metal shavings, copper wire, clear plastic, nuts and metal washers on the floor near the open reactor cavity.
- During the time of the OSART mission a worker dropped a dosimeter into the fuel pool.
- The plant has experienced an event where foreign materials cause an electrical short in the main generator, which resulted in a plant trip.
- Personal working in the turbine hall of unit 3 did not control small things in their pockets. The team observed that tools could fall inside the open turbine and no signs showing precautions had been installed. This work area was also not limited for access.
- Manholes opened in different heat exchangers are not closed or covered to avoid the introduction of foreign materials.
- Isolation works in the new steam generators (SG) do not have not enough protection devices to avoid foreign material from falling into the reactor cavity.

Foreign materials could cause damage in safety related equipments and could contribute to damage in fuel elements or SG tubes resulting in broken safety barriers leading to radiation release. Foreign material in the turbine or generator could also lead to plant transients.

Recommendation: The plant should improve their FME program in order to ensure that safety related and important equipment and structures are adequately protected from damage.

4.6. MATERIAL CONDITIONS

4.6(1) Issue: On both units 3 and 4, the material conditions are not consistent with IAEA safety standards and good international practice, and a general state of degradation exists. On units 1 and 2, although great improvement has been accomplished, some improvements could still be made. The team observed the following conditions:

- In plant common areas and thoroughfares of BAN 08, there are a lot of cracks, paint peeling and debris in the drainage channels that prevent water from fully draining.
- Contaminated tools and equipment had not been stored inside the contamination area, making it possible to spread contamination to other plant areas.

– Within a contamination area, supports and equipment have been removed, leaving walls with holes and unpainted surfaces.

– Plant rooms containing charging pumps 3 and 4 RCVxxx PO have the same type of problems. e.g. the pump plinth had not been painted which would lead to further contamination problems.

– The temperature in pump room 4 RCVxxx PO that is running is significantly higher than that of the equivalent pump rooms in Units 1 and 2.

– Small leakage with boron traces was observed in 4RCV001PO and 4RCV002 PO.

– Pipe and equipment thermal insulation materials have deteriorated in several places in turbine building hall. e.g. auxiliary pipes around TPA APP, APP139 VL, pipes in the area around pump system GFR.

– Paint on big and small materials are deteriorated and the team found several materials with dust, oil and leakage or remains of old leakages. e.g. All 4CTA006 PO deteriorated aspect and significant external leakage in 3 pumps. TPA s APP system, 4ACOxxxPO, 3 and 4 SRIxxx PO, SAP001CO air compressor with oil leakage, which seems regular, 4RRI001 and 003PO dirty with grease spreading.

– 4GSYxxxPO protective panel had been remove on 18-12-01 for a work, which has not started yet (23-1-02).

– A valve sealed with "furmanite" several times (unnamed) near 4ARE302VL.

– I & C cables are poorly protected in points going out from rigid conduits or entering in sensors with cover damaged. Special attention must be paid for sensors installed in areas with systems where a potential H2 leakage could occur. Systems GRH generator hydrogen-cooling system and GST stator cooling water system. In the cables of sensors 3GRH and 4GST deficiencies have been detected.

– Some instrument tubing is in contact with other tubing. Friction is creating wear.

– Level switches in sumps in turbine buildings 3 and 4 are not correctly supported.

– 4SIT017MG leaking water.

– Battery rooms W342 and 343 present bad state of cleanliness and remains of acid stains on the floor.

– Poor lighting in rooms or areas e.g. 3EAS001PO, 3DEG101GF, TPA's areas.

The material condition degradation process trend is dynamic and could affect, in the short term, other equipment important for availability or safety.

Without keeping plant equipment and structures in good material condition, a state of gradual plant degradation could exist. In addition, plant personnel will become used to accepting a lower standard for plant material condition than that expected by good international practice and IAEA safety standards.

Recommendation: The plant should improve the material condition of Units 3 and 4 to equal or better standards reached in units 1 and 2. Although units 1 and 2 material condition is substantially better, some improvements could still be made and continued emphasis on unit 1 and 2 is needed.

5. TECHNICAL SUPPORT

5.1. ORGANIZATION AND FUNCTIONS

The plant technical support (TS) organization consists of a core group of engineering specialists for analysing the performance of specific equipment such as valves, rotating machinery, instrumentation and control, and electrical. In addition methods engineers are assigned to each functional maintenance and operating organization. The TS staff were found to be very experienced and knowledgeable of the status and requirements in their subject area. For example, the valve engineer produces an annual report that provides highly detailed reviews of the contribution the different types and manufactures of valves in relation to plant costs and labour.

The number of staff providing technical support is sufficient to accomplish the required tasks to support safe operation.

The TS engineering organization has a line accountability through the assistant director of support to the plant director. The organization is reinforced by a large central engineering capability that manages the support of the entire EDF fleet of plants from central locations in Lyon, Paris and Marseille. There is good knowledge in the organization for the responsibilities and interfaces to support work in the plant.

The plant intends to change the reporting relationship of the engineering organization to become one of the advisory units to the plant director. This is being done to improve the ability of the engineering department to influence the other departments in the plant.

The powerful central support structure inherent in the EDF fleet concept provides both benefits and disadvantages. The benefits include the availability of very knowledgeable experts to bring to bear on large scale issue resolution and modifications. This allows the plant to focus its resources on safe day-to-day operation. The disadvantage of this concept is the time that it takes to install modifications given that these must be produced and installed in series for a whole line of similar plants.

The TS function at Tricastin NPP is effectively implemented for the majority of activities. However, during the course of the OSART visit, there was some indication of a willingness of staff to accept the status quo for longer term TS issues because the resolution request had been transferred to Lyon, Paris or Marseille.

The plant could not provide evidence during the review that sufficient technical support had been provided in some areas of generic engineering analysis such as seismic effect of temporary installed equipment and shielding and the behaviour of some reactor building materials following a Loss of Coolant Accident. The team made recommendations in this area.

5.2. SURVEILLANCE PROGRAM

The surveillance test program is specified centrally at the corporate engineering support unit and implemented at the plant. It is based on design and technical specification requirements. The plant departments that have the accountability for carrying out these tests also exercise the responsibility for producing the test procedures, implementing the tests and recording and analyzing the test results.

All tests are subjected to immediate first level checking and analysis to ensure that any deviations are managed in compliance with requirements and follow up checking and trending to predict and prevent degradation of safety margins.

Tests involving some critical parameters have been subjected to detailed risk analysis and special procedures have been produced to coordinate cross functional teams.

Good communication and feedback exists between the operation and maintenance functions during the planning and execution of the program. Test procedures have clear cross-references to limits and acceptance criteria. The computerized work management system (SYGMA) is used for managing the periodicity and results of the test programs in operations, maintenance and during outages.

Instrumentation and equipment used for surveillance testing is demonstrated to be accurate and regularly calibrated. This program is managed by the maintenance department metrology section and supports the trending and analysis of the test results.

In two cases in the year 2000, test execution exceeded periodicity requirements. Corrective actions were taken following the second event, that have been effective in preventing further occurrences.

The surveillance program is comprehensive, adequately documented and effective in ensuring the design requirements are met.

5.3. OPERATIONAL EXPERIENCE FEEDBACK (OEF) SYSTEM

Operational feedback internal to the plant is managed by each functional department or advisory unit. Some departments have begun to create and collect information and trends on lower level events and precursors, however there is no common database for storage and trending of these, nor is there a common threshold for these events or precursors. The team suggested that improvement could be made in this area.

All departments process operational experience in compliance with site and corporate expectations. The operations department has a specialist devoted to the collection and distribution of events. On a weekly basis the shift operating team reviews both internal and external operating experience reports. This is effective in maintaining staff awareness of this information. EDF information focused on a specific evolution is provided as part of the pre-job briefing package to the operators executing the work.

Significant and reportable events are entered into the SAPHIR database for use in communicating feedback to the other plants in the EDF fleet. This data is also used by the central corporate engineering support organization to consider generic problems.

Two human performance consultants are in place at Tricastin NPP. They provide consultative support to individual departments when requested, review experience feedback on significant events when requested and provide training in human performance to a cross section of 30 staff volunteers from all site organizations. The plant has already trained 10 volunteers to assist in this effort, with another 8 presently undergoing training. The training combines classroom and practical experience and should be effective in improving the capability of individual departments to analyze and solve human performance issues. At this point, the two human performance experts do not perform an initial screening of all events. This would help to ensure consistency and thoroughness in the analysis of events. Although the plant performs root cause analysis of all significant events, in one case observed the corrective actions were neither effective nor broad enough to prevent the inappropriate job site activities from reoccurrence. A recommendation was made by the team in this area.

5.4. PLANT MODIFICATION SYSTEM

Permanent plant modifications on safety related systems are produced and coordinated for the EDF fleet by the corporate engineering organization. This corporate organization provides the assurance that the modification meets all codes and standards, and that the plant will remain within its design basis after the modification.

The plant has responsibility for the production of modification packages on systems not related to safety. In all cases, the plant modification department translates the engineering documents into field execution packages and acts as project manager for the execution of this work. Modifications are installed in a series fashion across all applicable units in the EdF fleet, with enough time in between installations to incorporate experience feedback. The result of this is that the response time of corporate engineering to requests for modifications may be long as the package has to be created and introduced across the EDF fleet.

Modifications are effectively managed to ensure the necessary documentation is updated and training is complete prior to placing the modification in service, however, the team observed some open actions from modifications introduced in the outages for previous years.

Working files and permanent records of modifications are complete, thorough and up to date.

Temporary modifications have been installed to correct some design deficiencies primarily in the set points for alarm and process control. Some of these modifications have been in existence in all 4 units for several years with some greater than 10 years. There are no controls over the time limit these temporary modifications can be installed. A suggestion for improvement was made by the team in this area.

5.5. REACTOR ENGINEERING

Reactor physics and core management plans and studies are produced by corporate engineering organizations. The details of the reactor physics and core management are performed by computer codes and tools common to EDF. The analysis and documentation produced by these groups is thorough and comprehensive.

Core loading plans produced by the corporate engineering organization are checked by the fuel manufacturer and then validated using an in depth quality assessment.

Reactor physics surveillance tests carried out during start-ups are proceduralized and executed by the plant operations and maintenance testing organizations. These procedures are of high quality and are reviewed by the central engineering organization. However, mark-ups and corrections during the execution of these procedures were not required to be individually initialled and dated. Representatives of the corporate engineering organization are present throughout these start-up tests to act as consultants and technical advisors. This practice ensures independent quality assurance of the testing process.

Fuel defect monitoring is carried out by the plant chemistry department according to requirements and is executed within normal expectations.

5.6. FUEL HANDLING

The central nuclear services department (GNU) carries out fuel handling operations at the plant. Handling and storage of fuel includes special provisions for the MOX fuel used at Tricastin NPP. This process is performed within normal expectations.

Water condition in the spent fuel pools is satisfactory. There is a painting and coating program for the floor and walls of the fuel buildings and it has been successful in improving the material condition of the facility.

Tools and procedures used in this process are in good condition. During review of the spent fuel pools and the Unit 3 fuel pool and reactor cavity, deficiencies in the foreign material exclusion process were observed and are reported in the maintenance section of this report.

5.7. COMPUTER APPLICATIONS IMPORTANT FOR SAFETY

Plant process computers are effectively managed using accepted configuration control practices. Modifications are produced offline and then installed in the plant computers. A post installation validation process is executed effectively.

The plant I&C maintenance department provides initial maintenance response. A comprehensive manufacturer support program ensures the availability of spares and provides quick turnaround for returning equipment to service.

Obsolescence issues for the computer equipment are addressed effectively by the EDF central organization for computer support.

The plant process computer organization maintains a local copy of the software files, with backups located in Marseille. It was observed that the local copy of the files is not stored in fireproof filing cabinets and there is not a documented or practiced disaster recovery plan.

DETAILED TECHNICAL SUPPORT FINDINGS

5.1. ORGANIZATION AND FUNCTIONS

5.1(1) Issue: Engineering support activities do not always provide sufficient demonstrable analysis to give assurance that the installed systems can meet their design intent under all conditions.

Supporting Evidence:

- During the OSART review, the plant could not provide sufficient evidence that the thermal insulation being installed in the Unit 3 reactor building had been reviewed for impact on the clogging of emergency coolant injection and recovery strainers following a Loss of Coolant Accident. International experience is that this review needs to be done since the type of insulation being used has been shown to have the potential to block strainers.

- Cable trays are heavily loaded in many plant areas. One cable tray was observed to be deformed. Although this problem has been recognized and some review and repair work has been performed, an engineering analysis has not yet been performed to consider the consequences of this heavy loading with respect to insulation damage, overheating fire loading, seismic effect and the ability to troubleshoot and replace.

- Some equipment and material was found located adjacent to seismically qualified systems. The plant could not demonstrate that the potential to damage or render these systems unavailable during an earthquake had been addressed. Examples include heavy breaker tooling temporarily placed near a seismically qualified breaker and temporary lead shielding.

Without a thorough engineering analysis for all deficiencies and equipment conditions, some systems may not be available when required to support plant safety under all conditions.

Recommendation: The plant should establish that there is sufficient analysis to demonstrate that the installed systems meet their design intent under all conditions. These analyses should include:

- Detailed engineering review and design requirement for the type of insulation used and the installation standards for reactor building piping thermal insulation taking into account the post-LOCA strainer blocking information available in the industry.

- An engineering review of temporary placement of equipment for affect on nearby seismically qualified equipment.

- A comprehensive review of all cable trays for loading that may cause insulation damage, overheating, fire loading, seismic effect and ability to troubleshoot and replace.

- In the absence of such analysis and review, mitigating operational actions could be put in place until the analysis is performed.

5.2(2) Issue: The control of temporary biological shielding is not sufficient to ensure that shielding is installed in a manner which assures it will accomplish its intended radiological function without adversely impacting other components, systems, areas, etc.

Temporary biological shielding was noted, on several occasions in Unit 3, to be installed directly onto pipes without an analysis of the structural effects that could result from its installation.

A large amount of temporary biological shielding is stored in Unit 3 without control.

Temporary biological shielding was installed by contractors directly onto steam generator piping in Unit 3 in quantities that complied with their "professional judgment" as opposed to any engineering analyses.

Temporary biological shielding on wheels was installed (Unit 4, Room K-216) without having been assessed by the technical support organization for its long-term benefit or its potential for being incorporated into a permanent plant modification package.

The improper control and installation of temporary biological shielding could result in its inability to provide the protection for which it was intended, and could result in the structural failure of equipment and systems with which it interacts.

Recommendation: Plant management should establish controls sufficient to ensure temporary biological shielding receives adequate analysis to assure that the shielding will accomplish its radiological function without adversely impacting other systems or components. In particular, analysis should be done for lead shielding hung on piping.

5.3. OPERATIONAL EXPERIENCE FEEDBACK (OEF) SYSTEM

5.3(1) Issue: There are weaknesses in the analysis and implementation of corrective actions for events related to inadequate work site conditions and activities, including human performance activities.

- Following a generator trip caused by foreign material, recommendations were made to improve the Foreign Material Exclusion (FME) practices for generator work only. FME practices continue to be deficient in the generator work and other important areas. Examples are turbine overhaul and the spent fuel pools. (Note that details of the deficiencies of FME practices are discussed in the Maintenance section of this report).
- During the OSART mission a personal dosimeter was dropped into the fuel pool.
- Safety related instrument tubing was installed with the tubing in contact. Subsequent rubbing has caused wear on the tubing. No analysis of this condition has been performed.
- Although there are human performances experts at the site, and a cross section of staff are being trained in human performance analysis techniques, not all events are subjected to an initial screening for human performance. An example is the reportable event of July

13th, 2001 where the plant start-up was begun without lubrication supply to one of the turbine bearings. This event was not subjected to human performance analysis.

Work site events that are not thoroughly analysed for the root causes and corrective actions that are not implemented or insufficiently comprehensive increase the probability of safety and production significant events.

Recommendation: The plant should strengthening their analyses of work sites and work site related events, including human performance activities, in a proactive way and implement sufficient preventive actions in affected work sites activities.

5.3(2) Issue: Although the plant has started to increase the reporting of low-level events, there is not a common system, threshold or database to collect and analyse these events. This issue has been identified in OSART reviews at several other EDF plants. in EDF.

The threshold is defined at the corporate level for significant events affecting safety only and there is no corporate directive for low level reporting.

The following are examples of items not recorded in a common database of precursors, some are not reported and others are reported in separate databases:

- Procedure deficiencies.
- Valve isolations and tagging errors
- Maintenance rework.
- Improper radiological practices.
- Poor industrial safety practices and minor accidents.
- Industrial safety hazards.

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 validate the effectiveness of current action plans. This would help identify precursors to prevent more significant events from happening

Suggestion: The plant should consider continuing with the effort to increase low level event reporting and should consider the use of a common database for the recording, review and analysis of these events.

5.4. PLANT MODIFICATION SYSTEM

5.4(1) Issue: The plant does not control the length of time that temporary modifications are installed. Some temporary modifications installed in the operating systems have been there for several years with some greater than 10 years old. The team observed the following:

- Temporary modifications involving the pressure control set point for the H2 tank on the RCV system have been in place for greater than 10 years on all units.

- Temporary modification dated 19/04/1999 on OSDX151AB on the control of pH in the neutralizing tanks.
- The plant has recognized this issue and has instituted risk analysis for all temporary modifications. As well, some progress has been made in the conversion of temporary modifications on non-safety related systems to permanent modifications, however installation of permanent modifications on safety related systems requires support and review from the central nuclear engineering department with its inherent long time requirements.
- Some plant documentation connected with temporary modifications will not be updated until a permanent modification is produced. The engineering review for temporary modifications is not as thorough and comprehensive as for the permanent modifications.

This lower level of review and support increases the probability of a loss of configuration control, and creates the potential for the installation of an inappropriate change to a safety related system.

Suggestion: The plant should consider establishing controls for the length of time that temporary modifications are installed. As part of these controls, the plant should consider performing in-house engineering reviews and documentation updates equivalent to permanent modifications on temporary modifications exceeding a specified installation time.

6. RADIATION PROTECTION

6.1. ORGANIZATION AND FUNCTIONS

Responsibilities in the area of Radiation Protection (RP) are distributed throughout the various organizations that work at the site. This includes the RP department, other Tricastin organizations (e.g. Operations, Chemistry, and Nuclear Logistics), and the various contractors that support plant activities. Additionally, at Tricastin NPP, the industrial safety and medical responsibilities associated with the protection of workers are consolidated under the Radiation Protection department. This has resulted in the development of broad directives that provide guidance for assuring the overall safety of workers. The responsibility for the implementation of these directives rests with the individual work site supervisors, a process that is generally understood by all personnel.

The RP department has developed numerous indicators for tracking and assessing performance. These indicators primarily address issues associated with their compliance with regulatory requirements and, therefore, focus on long-term considerations. They provide management with insights sufficient to identify and correct performance deficiencies. Outlier data is analyzed and assessed and the lessons learned are incorporated into the site's experience feedback process.

The RP department is staffed with ~ 45 technicians. They are assigned to one of two branches, responsible for either operational applications or policy and procedure development. While these numbers may seem low for a 4 Unit site, work activities are mostly contracted and each contractor (and the individual work site supervisor) is responsible for the establishment, implementation and oversight of radiation protection activities; effectively, this supplements the RP staff with an RP presence at each work site.

In 1999, there was a significant irradiation event, which occurred at the site. This event provided an incentive for substantial improvement initiatives in the RP area. As an outgrowth of this push for improvement, the Tricastin NPP staff has assumed a leadership role in developing and piloting many RP improvements. Examples include the development of tracking software to manage preventive and corrective maintenance activities on radiation protection instruments, and the identification and procurement of Commercial-Off-The-Shelf (COTS) industrial type cases (type A) for transporting sources, both internally and externally to the plant.

Overall, the training and qualifications of the RP staff are acceptable. Radiation protection training for contractors is accomplished by nationally certified institutes and the plant staff provides site-specific information. Tricastin staff are co-trained by the on-site training and RP departments. Operational experience feedback is consistently provided through refresher training and through a weekly Health and Safety meeting with all contractors.

6.2 RADIATION WORK CONTROL

The control of radiological work at Tricastin NPP is being accomplished in an effective manner that assures the overall health and safety of plant personnel. Work planning is a cooperative effort between the EDF department that orders the work activity; the contractor, who is responsible for all aspects of personnel safety on the job site; and the RP department, which provides overall oversight of personnel safety practices on the site.

Each work site contractor, with guidance from the ordering EDF department, must develop a risk assessment plan that addresses all of the potential worker safety issues for the particular job. The work site supervisor is legally responsible for the implementation of this plan and includes assuring that appropriate radiological protection measures are present. Pre-job planning and orientation are required and are conducted a few days prior to the commencement of the overall work activity and immediately prior to each work task.

Because of the contractor's safety responsibility, the RP department does not have to provide the on-the-spot controls at every work location within the Radiological Controlled Area (RCA); instead, they appropriately define the different areas inside the RCA (green, yellow, orange, red), and oversee the contractor's compliance with national and site directives. RP personnel do provide the direct support needed for EDF-performed job activities and provide consultation services to a contractor, if specially requested. This decentralization of the direct oversight responsibility has resulted in some consistency challenges.

During the review, it was noted that Radiation Worker practices were not being consistently adhered to and implemented. Workers were not appropriately attentive to the details associated with the controls and procedures that have been put in place by EDF and some supervisors were not aggressive in correcting these deficiencies on the spot. A recommendation to develop more effective means to assure workers implement Radiation Worker work controls and procedures was made by the team.

There was also a lack of consistency in the posting, labeling and special provisions used to control work areas. The team noted instances where survey maps depicting the radiological conditions within work areas could not be easily verified for their accuracy and currency. These deficiencies could lead to worker confusion and to personal exposures beyond those expected and not as low as reasonably achievable (ALARA). A suggestion to consider establishing better controls for the posting, labeling and special provisions associated with work areas was made by the team.

As part of their initiative to improve all aspects of worker safety, the RP department has initiated a program to encourage, at the individual and contracting organization level, compliance with and adherence to industrial and radiological safety practices. The "Safety Challenge" is a weekly program wherein each contractor's safety practices are assessed, at one of their job sites, by a senior Tricastin manager. Attention is given to the preparation of the risk assessment, which includes radiological considerations. Additionally, an on-the-job assessment of the implementation of radiological protection measures is conducted. Individual and corporate incentives are provided to each "winning" work site. This is a unique program for improving the overall safety practices at individual work sites.

6.3 RADIATION DOSE CONTROL

Improvement of the radiation dose control program at Tricastin NPP has been a focal point for several years. However, on 11 March 1999, a member of the RP staff experienced an overexposure while conducting work in the Unit 1 reactor cavity. The continuing emphasis by management on improving performance has been reflected in several performance measures and has resulted in a program that meets overall international expectations.

In 1992, approximately 27 members of the Tricastin workforce accumulated > 20 mSv per year. A dose mitigation program was instituted and has produced consistently improving results so that by 2001, there were no occurrences. This success has been the result of a cooperative effort between the work planning function, the dose monitoring of staff members, and the institution of an individual dose reduction strategy. This strategy institutes alarms and controls at the 16 mSv and 18 mSv levels, respectively. Through a cooperative effort between the site physician, the RP department and the contractor a jointly developed mitigating strategy is established to ensure that the worker's future work assignments support the overall strategy. The level of success (100%) that has been experienced in reducing the number of individuals with exposures above 20 mSv has not been seen in the overall exposure rate at the site; however, a 20% reduction in the overall exposure has been realized. The site remains, however, above the EDF average (per reactor) due to the high dose work projects (for example, 10-year outage and steam generator replacement that have occurred recently).

The site is also attentive to assuring appropriate controls and protection capabilities are present to guard against internal exposures. Whenever a potential internal exposure activity is planned, a review of the protection measures for ingestion is mandatory. Additionally, any uptakes result in the immediate involvement of the medical staff

Work planning incorporates ALARA considerations into the initial, on-the-job and post-job activities. During the planning process, the ordering department is required to make the contractor aware of any potential radiological challenges. This is reinforced during the pre-job orientation. Feedback is solicited continually during the conduct of the job through audits by both the ordering organization and the RP department. Each milestone of the work activity is tracked to ensure that timely reaction to any unexpected dose accumulations can be made. Finally, the post-job review provides an opportunity to incorporate insights into the planning file for the next time the task is scheduled.

6.4 RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING AND FACILITIES

The instrumentation used at the Tricastin NPP is effective and is being appropriately used for the designed applications. Individual dose monitoring equipment is effective and is available for all potential applications. Specific needs (e.g. neutron dosimetry) are noted as part of the risk assessment for the particular work activity. Gaseous and liquid effluent monitoring equipment are properly installed and functional. The responsibility for the use of the instrumentation is shared primarily between the RP and Chemistry departments. Functional verifications are the responsibility of the Operations department and maintenance is the responsibility of the instrumentation and control division of Maintenance.

The practices for protective clothing at the site reflect the EDF philosophy of treating the RCA as a potentially contaminated area, thus requiring all individuals who dress out in anti-contamination clothes, to include cotton gloves and hard hats. This practice is well understood by all staff members.

The instrumentation used for portable and fixed dose rate and contamination measurement is an area where the Tricastin NPP staff has taken a leadership role for EDF. Conventional instrumentation for contamination reads out in count per second (cps) and typically requires that the technician conduct a conversion process to Becquerels/Curies. Additionally, an accurate reading requires the operator to assure that the instrument is on the proper scale. The Tricastin NPP staff has developed a meter which is sensitive to beta and gamma activity, is self-scaling, and reads out in Becquerels, thus making surveying a simple and, basically, error-proof activity. This instrument has improved technician efficiency and is being integrated into the inventory of several EDF plants. Finally, the staff has shown a unique competence by developing, with a local vendor, a water equivalent matrix type resin source. This source, which is easier to use and inherently longer lived, has been recognized by the team as a good practice.

6.5 RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

The program for managing the production and discharge of gaseous, liquid and solid wastes at the Tricastin NPP is well managed and is capable of accurately assessing the releases that are associated with both normal and abnormal operations. Tricastin NPP has improved significantly in its control of liquid releases and is in the top quartile of EDF performance.

Effluent monitoring instruments are positioned in such a manner to effectively monitor the impacts of gaseous and liquid releases at the site boundary and the surrounding environment (out to 10 Km). Appropriate attention has been given to assessing any deviations from the norm. Fixed and portable monitoring capabilities are in place and appropriate quality verifications are present.

Gaseous monitoring is accomplished through direct reading radiation monitors. Releases are managed to minimize their impacts through engineering considerations (hold-up tanks and filters) and process controls. Liquid releases are likewise closely controlled and monitored. A unique design feature of the Tricastin NPP is the underground retaining wall that surrounds the site and establishes an inward water flow pattern. Also, an effluents improvement team, consisting of members from throughout the site organization, has been formed to better manage the reduction of liquid effluents.

Solid radioactive waste is processed through a separate facility. The Nuclear Logistics department manages it and daily operations are contracted. Materials are segregated by hand. This job has the potential for significant internal contamination and, therefore, requires the use of forced air breathing suit. Within the facility, waste is segregated by its ultimate destination. During the review, it was noted that the fixed monitoring devices within the radioactive waste building could be improved. The air monitor present was not one that continuously read the activity in the air; instead, the filter for the sample was only counted every 2 weeks. Similarly, gamma monitoring was only available through the use of personnel hand-held (Dolphy) dosimetry. While, to date, there has been no inadvertent exposures at the facility, these shortcomings preclude real-time monitoring and do not provide the level of assurance expected. A suggestion to consider installing continuous air activity measurement and permanent ambient monitoring devices was made by the team.

6.6 RADIATION PROTECTION SUPPORT DURING EMERGENCIES

Overall, the radiation protection support provided during emergencies meet good international practices. The responsibilities for providing radiation protection support during emergencies are shared between the Nuclear Logistics and RP departments and the medical staff. Medical personnel are on call for emergencies with doctors on call for radiological emergencies. Resources are shared with the Cruas nuclear power plant to assure their continual availability.

Radiological measuring equipment includes both fixed devices and two mobile vans. Detectors and meters are checked regularly; back up power is available, as necessary. Detailed directions (including pictures) assure that fixed monitors can be located and monitored in a timely manner.

The controls for monitoring the radiological effects on plant personnel during accident emergencies are effective. Personnel monitoring is conducted by RP and medical personnel at the emergency evacuation point in Saint-Paul-Trois-Châteaux. Monitoring and decontamination of the evacuation vehicles is also done at this location. Many additional site personnel are qualified and are available to assist the dedicated RP staff, especially in preliminary contamination monitoring at the initial mustering points.

Radiological impacts are communicated to the local officials responsible for public safety based upon an assessment from a formalized flowchart. The consequences of the releases are determined by using a dedicated code and measured data from the meteorological mast (80 m) that is shared with COGEMA. Both effective and thyroid doses are calculated. The consideration of collected and non-collected release paths makes predicted impacts as accurate as possible.

DETAILED RADIATION PROTECTION FINDINGS

6.2 RADIATION WORK CONTROL

6.2 (1) **Issue:** Radiation Worker work practices are not adhered to consistently. The workers are not consistently attentive to the details of the controls and procedures that have been put in place.

There were several instances where Unit 3 contractor “guardians” did not observe the radiation protection expectations that have been established by EDF (e.g. wearing gloves and hat; reading books).

A staff member accidentally stepped onto a “clean” step-off pad while wearing potentially contaminated overshoes (Unit 3). The “clean” step-off pad was not surveyed to see if it had become contaminated.

Several instances where craft personnel were noted not to be wearing gloves within the RCA, as required (individual seen carrying 3 bolts in his bare hand because the cotton glove was “not convenient”; individual seen exiting the Unit 3 “hot” changing room without cotton gloves).

The compliance of Radiation Workers with the procedures that have been established to assure their individual safety is essential since radiation protection technicians are not continuously available to monitor and coach workers on proper techniques. Workers must, therefore, be the primary agents responsible for their own safety.

Recommendation: Plant management should develop means to assure that all plant workers effectively implement Radiation Worker work controls and procedures.

6.2(2) Issue: The posting, labelling, and special provisions provided to keep dose as low as reasonably achievable (ALARA) are not being implemented in a manner consistent with good international practices and are more focused on national regulations.

Survey maps for work sites were not updated and posted when they were completed because the radiological conditions had not changed from the previous survey.

In Unit 4, room K-216, there was an orange area (second most significant level) which did not have a thorough survey of the area posted.

A Chemistry Technician, who took a primary sample (Unit 3) to perform an analysis let the bottle with the .1 liter sample (activity ~8MBq/kg) stand on the work table for the duration of the analysis (30 minutes) without reducing the exposure impacts (ALARA) by placing the bottle behind temporary shielding which was immediately available.

Posting and labelling radiation areas, and establishing special provisions to keep dose ALARA in a manner which allows plant personnel to quickly and unambiguously know and understand the radiological conditions in which they are working is essential for assuring individual worker safety.

Suggestion: Plant management should consider developing and implementing more effective controls and procedures to assure that posting, labelling and special provisions are implemented in a manner, which emphasizes and supports good international practices, in addition to compliance with national regulations.

6.4. RADIATION PROTECTION INSTRUMENTATION, PROTECTIVE CLOTHING, AND FACILITIES

6.4 (a) Good Practice: The Radiation Protection Department has assumed a leadership role in developing for EDF products and processes to improve the company's overall radiation protections practices.

The chemistry laboratory, working with a local commercial supplier, has developed and is using radioactive sources containing a water equivalent matrix type resin. This solid phase source is considered as a sealed source. As such, its lifetime (depending on the radio element contains) is 10 years rather than the 2-year life normally specified for unsealed sources. These sources are supplied in standardized shapes, identical to those currently used for measurements, and are available in 3 different sizes (3.0 l, 0.5 l and 50 ml).
Compared to liquid sources, the advantages of this product are as follows:

- No handling of liquid radioactive sources
- No radio element migration phenomenon within the source container
- Source retrieval by vendor (no destruction requirement)
- Longer period of use (depending on the radio element half life)
- No spread of contamination in the event of being dropped

6.5. RADIOACTIVE WASTE MANAGEMENT AND DISCHARGES

6.5(1) Issue: Environmental monitoring in the Solid Radioactive Waste building could be improved.

The Solid Radioactive Waste facility is a facility used to sort and consolidate solid radioactive wastes that have the potential for generating airborne contamination as well as increases in ambient radiation levels.

The filter for the air monitor is not automatically counted; therefore, there is no continuous alarm capability. The filter is counted every 2 weeks by a Radiation Protection technician and the results are posted in the work area.

Only 2 portable dose meters (e.g. Dolphy) are available in the Solid Radioactive Waste facility. Because of this, there is no continuous or consistent monitoring of the ambient radiation levels.

The quantities of radioactive waste stored in the facility establish a potential for unexpected exposure which, if not monitored, could impact personal safety.

Suggestion: Plant management should consider installing in the Solid Radwaste Building a Continuous Air Monitoring device and permanently mounted radiation detectors with "real time" monitoring and alarm capabilities.

7. CHEMISTRY

7.1. ORGANIZATION AND FUNCTIONS

At Tricastin NPP, the activities related to the field of chemistry and radiochemistry are under the responsibility of the Chemistry and Environment Department (MCE). The MCE department and operations department make up the "production" group. The laboratory branch of MCE is divided into two parts: plant chemistry and environmental chemistry. In addition, the method team, which is composed of experienced chemists, is responsible for planning activities and for drawing up procedures and instructions. There are also chemistry experts in the engineering department responsible for long-term tasks within the fields of plant and environmental chemistry. Responsibilities of this group are described in the Engineering department organisation memorandum.

Plant chemistry is responsible for the chemical treatment at the installation, primary to secondary leakage monitoring and for fuel integrity monitoring. It is also responsible for implementation of necessary corrective actions, when deviations are identified.

Environmental chemistry is responsible for the production of demineralised and drinking water, as well as liquid and gaseous releases measurement. It is also responsible for performing qualitative and quantitative sipping tests, when a leaking assembly is identified.

There are no shifts in the chemistry area, but there are eight on-call chemists at all times, ready to help the operation staff when a chemistry anomaly appears.

The interface responsibilities and the corresponding flow of information to operations are clearly described. MCE staff has regular daily communication with the control room operators. The control room staff has access to the chemistry results.

Chemistry has established a very comprehensive system of chemistry performance indicators. The assessment of performance is regularly carried out. The team proposed a good practice in the area of chemistry performance indicators. A pilot project of self-assessment was also performed in the chemistry department using the EFQM principles. The main weaknesses of the performance were identified by evaluation of nine criteria. A comprehensive action plan was established by the department head with the aim of improving the performance of the department.

Contractors are used for maintenance of on-line analysers and must be approved at corporate level.

Training and qualification responsibilities are clearly defined in the training memorandum. Certain levels of authorisation are prescribed for each hierarchical level. Each employee has his own individual training record. Training is sufficiently monitored by managers. Shadow training for the new workers is performed. The job rotation within the workstations is conducted within both parts of the laboratory branch.

There have been significant improvements in the recent past connected to the effective restructuring of chemistry.

Corporate level organisations play an important role in the field of chemistry and radiochemistry. The most important ones are the Chemical and Metallurgical Laboratories (GDL), the Environment Group (GENV) and the Fuel Branch of the Engineering Support Unit (UNIPE), which are involved in establishing the specifications and policies in the chemistry area. They also collect the results and communicate the experience feedback among the plants.

7.2. CHEMISTRY CONTROL IN PLANT SYSTEMS

Chemistry control of the plant and monitoring program for the primary and secondary systems were established by GDL based on materials used in the plant.

The chemistry specifications are well defined and structured and the expected values and limit values for every parameter are determined. If the expected value is exceeded, a possible anomaly should be identified and eliminated in order to get back to normal operating conditions as soon as possible. A corrective measure must be carried out immediately when a limit value is exceeded. Chemists determine the best action to be carried out to get back to normal values.

Primary chemistry is well maintained using the co-ordinated lithium/boron treatment. Appropriate consideration is given to start-up and shutdown chemical treatment when the special chemical specifications were implemented with the objective of dose rate build-up minimisation. Dose rate build-up is regularly checked during outages. The in-situ gamma measurement is provided regularly by the corporate level organisation. The modified lithium/boron chemistry treatment has recently been used in Unit 4 so as to decrease the value of high temperature pH. Up to now, the steam generators in units 1, 2 and 3 have been replaced.

The automatic injection system of lithium to the primary circuit was established in Unit 2. The team recognized as a good practice the automatic injection of lithium.

Secondary chemistry is well maintained according to the specifications which were modified after condensers were replaced with implementation between 1992 and 1995. In the recent past, problems with the quality of condensate appeared in units 3 and 4 caused by the intake of cooling water into the condensate. The erosion of some tubes in the upper parts of stainless steel tube bundles was identified by visual inspection. This problem will be addressed using protective plates.

The all-volatile treatment (AVT) is used which is established by injection of hydrazine upstream of the condensers. The feed water pH value is maintained at 9.5. Morpholine is injected downstream of the condenser extraction pump.

Modified secondary chemistry for unit 4 was established at the corporate level (GDL) using the injection of boric acid, to reduce the corrosion of steam generators. There are leakages from the primary to the secondary side of steam generators in this unit which have not reached limiting values and the steam generators will be replaced during the ten-year outage in 2004.

A mobile demineralisation station is used for the cleaning of the secondary circuit after an outage. A special demineralisation station for the generator stator cooling water system was also installed to improve the chemistry of the system.

The quality of demineralised water produced at the demineralised water production plant is properly monitored by on-line measurements of pH, conductivity, sodium and silica. The demineralised water production plant is automatically shutdown, when the conductivity of produced water exceeds a certain level.

Flow Accelerated Corrosion (FAC) is followed up by the mechanical department via the CICERO software for prediction of FAC damage in certain pipelines. Measurements of wall thickness and the chromium content are carried out for critical components.

Diesel generator fuel, lubricant oils and the diesel generator cooling water are regularly sampled and analysed.

An effective radwaste minimisation program was established on the liquid effluent releases. A multi-professional team was established, composed of representatives of different departments. The significant decrease of liquid effluent was achieved in the recent past.

7.3. CHEMICAL SURVEILLANCE PROGRAM

An extensive chemical surveillance program exists in accordance with the chemical specifications from the corporate level organisation.

The plant is equipped with on-line analysers for monitoring the main primary and secondary parameters. The records from on-line analysers are also registered in the control room and alarms for control room operators are provided when the limit values are exceeded.

All on-line analysers are properly and regularly calibrated.

The schedules and sampling plans of analyses are clearly identified by the corporate level MERLIN software system.

Good analytical procedures are easily accessible at every chemistry workstation. Laboratory analytical equipment is also regularly calibrated using the appropriate standards.

Analytical performance of laboratory personnel is checked using unknown samples or double-checks in case of problems with the analysis.

Laboratories regularly participate in corporate crosschecking analyses of chemistry and radiochemistry parameters. Twenty-seven laboratories within EDF plants participate in this crosschecking process. Significant improvements of laboratories occurred in the recent past. On-line analysers are also crosschecked regularly at corporate level.

Fuel integrity is monitored by gamma spectroscopy measurement of grab samples of primary circuit coolant. The steam generator primary to secondary leakage is measured by ^{16}N activity monitoring in steam. Alpha measurements are also performed for determining transuranium radionuclides activity within the plant systems and effluent releases.

Chemistry results are well documented and communicated by the MERLIN system.

7.4. CHEMISTRY OPERATIONAL HISTORY

The results of all the analyses along with some on-line analysers data have been computerised since 1984. Two years ago, the new MERLIN corporate level computerised system was applied. Three levels of trend analysis are performed. Team leaders generate weekly reports of the main important data.

The planning engineers are responsible for creating monthly reports with the trends of all important parameters for primary, secondary and environmental chemistry, as well as a description of the state of all three barriers. Monthly reports are communicated to the relevant departments and to plant management.

The engineering group chemists are responsible for creating the annual reports for secondary, primary and environmental chemistry. Chemistry is also included in the power plant annual nuclear safety report created by the nuclear safety department and communicated to the regulatory authority.

An appropriate system of experience feedback was established within the MCE department.

7.5. LABORATORIES, EQUIPMENT AND INSTRUMENTS

Most laboratories are appropriate for different analysis tasks. They are clean and well maintained. However, the secondary laboratories especially for Units 3 and 4, are more obsolete, all could be renovated. They will be renovated when on-line oxygen meters are replaced this year. Furthermore, some weights are not always used in accordance with good international practices. The team provided a recommendation on this issue.

Some laboratory instruments are very modern and all instrumentation has exceptional redundancy. Instruments are in good condition and are operated by skilled staff. The documentation including calibration data is kept close to each instrument. The laboratories and most of the chemistry areas are adequately equipped with emergency showers and eye washers. However, it was observed that the industrial and personal safety practices are not always in compliance with good international practices. The team provided a recommendation in this area also.

Samples to be measured in the hot laboratory are inserted in closed plastic bags for transportation.

Chemicals with one exception were appropriately labelled with the expiration date and recorded in the simple quality control information system.

All on-line analysers are labelled with the dates of the last and the next calibration. Different colours of labels are used for different areas. The regular periodic and preventive maintenance of on-line analysers is provided. A five year-annual plan is also established for the future replacement of analysers.

The plant has installed a sufficient post accident sampling system (PASS). The measurement of gas phase is performed by KRT chains (total beta activity and dose rate) and additional analysis will be performed at corporate level. The liquid phase could be sampled depending on the type of accident from the shielded cabinet at the hot laboratory (REN) or from the special shielded cabinet connected downstream of the low-pressure injection system pump. There is no special analytical equipment to perform PASS liquid samples. The total gamma activity and the gamma spectrometry measurement can be performed with the appropriately diluted sample.

7.6. QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

There is a comprehensive system of quality control of operating chemicals and resins established at corporate level (GDL). The criteria of purity and limit values of impurities for all operating chemicals are prescribed in the special procedures. A similar procedure also exists for all resins. GDL is also responsible for performance of all necessary analyses.

Every producer of operating chemicals or resins have to be certified by GDL. There is a list of allowed producers, products and packaging, certified by GDL and updated each time there is a change. All producers are audited every three years. Such a system also exists at corporate level, when a new operational chemical is needed.

Methods engineers are responsible for dealing with PMUC (Product and Material for Use in Power Plants) chemicals within the power plant. There is a specified process for checking chemical products delivered to the plant, and the MCE department also has a special warehouse for PMUC operating chemicals. A similar system is used for laboratory chemicals. All responsibilities and rules for necessary labelling, supply and checking of delivered chemicals are clearly described. However, the team observed that the control and storage of some laboratory chemicals, mainly substances used by maintenance or contractors, is not fully appropriate to prevent potential improper use. The team provided a recommendation concerning chemical labelling.

DETAILED CHEMISTRY FINDINGS

7.1 ORGANISATION AND FUNCTIONS

7.1(a) Good practice: A very comprehensive system of chemistry performance indicators is established. The main chemistry performance indicators connected to chemistry, radiation protection effluents and the environment are used with short-term trend evaluation (3 weeks). Expected and limit values of indicators are also expressed. The values are upgraded once a week and are easily accessible for all the plant's employees via the electronic IT system. In the form of a weekly newsletter with pictograms, the system is used for the presentation of chemistry results for plant management and other departments.

This type of relationship has the advantage of enhancing the commitment of plant management and other departments in the chemistry area. As a result, chemistry deviation treatment is performed more rapidly.

7.2 CHEMISTRY CONTROL IN PLANT SYSTEMS

7.2(a) Good practice: The automatic injection system of lithium to the primary circuit was established in Unit 2 as a prototype. The system uses a special software for continuous calculation of lithium needed for the circuit. The on-line measurement of conductivity with the feedback loop makes it possible to comply with lithium/boron specifications during operation and during hot standby. An alarm is provided to the control room operators when a problem occurs with the injection system.

This system is especially useful for power plants operating in load following mode with very frequent variation of power (up to the hot standby), which are always accompanied by boration and dilution operations. This phenomenon is compensated by an automatic lithium injection system, which is used to compensate in real time whenever the limit of the lithium-boron diagram is exceeded, and to prevent excursion at low pH. 25 load reduction transients were carried out, which qualified the prototype and the lithium concentration was constantly maintained with a deviation below 0.05 mg/kg relative to the reference value.

7.5 LABORATORIES, EQUIPMENT AND INSTRUMENTS

7.5(1) Issue: Laboratory practices and performances do not always correspond with the good international practices to ensure industrial and personal safety, and minimise doses.

- the fume-hoods at the central laboratory of Unit 3,4 are not regularly tested from the point of view of sufficient air flow.
- the chairs at the central laboratory of Unit 3,4 (controlled area) are not covered by material which allows easy decontamination of chairs (plastic). There are covered by textile.
- during the observation at the control area laboratory of Unit 3,4, the technician performing the sampling and analysis, left the bottle with the sample (about 1 litre of

primary coolant with activity about 8 MBq/kg) on the table without shielding while he was preparing the analysis (about 30 minutes). There was one of the shielding close by (about 0.5 m), with some other bottles behind it.

– the deficiency in industrial safety was observed during the visit at the chemistry stock of the laboratory of Unit 1,2. There are no protective tools (shield and apron) there, although the concentrated sulphuric acid (96%) in glass bottles is stored there. There is no eye washer or emergency shower there and the nearest source of water is about 30 m away with complicated access.

Without changing these laboratory practices the industrial, personal and radiation safety of workers can not be assured.

Recommendation: The good international laboratory practices and performances should be applied to assure the industrial, personal and radiation safety minimising doses.

7.5(2) **Issue:** Laboratory practices and performance do not always correspond with the good international practices to ensure the quality of analysis.

– The balance used for weighing of calibration standards (precision weighing) at the central laboratory of Unit 3,4 (controlled area) is placed on a special table, but directly in the corridor along the laboratory rooms. There is no special and separated space for weighing.

– Two other balances used for weighing of calibration solutions and reagents were observed at the environmental laboratory, and are not placed in a special and separated space with limited access. One of these balances was placed directly on the working table at the lab.

– During the visit at the REN laboratory Unit 3,4 (controlled area), the balance was observed, for weighing of calibration solutions and reagents (precision weighing) placed on a special table, but not placed in a special and separated space.

Without changing some laboratory practices the quality of analysis cannot be preserved.

Suggestion: Consideration should be given to improve laboratory practices and performance with good international practices. The team did recognize the good results from the cross checking analysis.

7.6 QUALITY CONTROL OF OPERATIONAL CHEMICALS AND OTHER SUBSTANCES

7.6(1) **Issue:** Control and storage of some plant chemicals and mainly substances used by the maintenance department or contractors is not fully appropriate to prevent potential incorrect use.

– during the laboratory visit (Unit 1,2 chemistry laboratory), the volumetric flasks containing some liquid were found in the capillary electrophoresis room. There was no expiration date of the solution on the label of one volumetric flask with standard solution (the mixture of chlorides, fluorides and sulphates). There was no label on the second volumetric flask, but only a hand-written indication of phosphate with additive.

- fireproof cabinets in the electrical warehouse contain chemicals and lubricants, which are not identified with the Product and Material for Use in Power Plants (PMUC) symbol. Plant policy clearly defines that only products marked with this symbol should be allowed for use in safety related metallic equipment in nuclear plants.
- during the inspection of the turbine hall of Unit 3, one person was observed using the conservation lubricant for turbine without any labelling specifying the approval for using it for this purpose.
- oily waste stored in a barrel, which was not labelled, adjacent to a GFR pump on Unit 3 was observed.

Improper storage and use of plant chemicals and other substances may sometimes lead to increase the risk of inaccuracy of analysis, potential corrosion or other negative impact on plant systems and equipment.

Suggestion: The plant should consider keeping up the efforts of the PMUC approach, which is already well established at the plant, so that products used by maintenance and contractors are at the same quality level as chemistry.

8. EMERGENCY PLANNING AND PREPAREDNESS

8.1 EMERGENCY ORGANIZATION AND FUNCTIONS

In France, a national policy exists to implement emergency preparedness on a national, regional and local level. Tricastin NPP, responsible for onsite planning, and the ”Préfet du Département de la Drôme” who is the regional authority in charge of offsite emergency planning and preparedness are well co-ordinated. EDF at the corporate level supports emergency planning. National authorities also support emergency planning and back-up while also maintaining international relationships. This close co-operation, communication and data transfer are well established between all partners and presents a good foundation for emergency preparedness. Together with the support supplied by the corporate level of EDF, gives a good basis for the utility to handle an incident or accident in an effective way and to protect the public in case of an incident or accident.

Responsibilities in all areas are well defined and staffing and resources are assigned to the emergency tasks. It should be pointed out that due to the commitment of the Tricastin NPP management team in charge of emergency planning, that improvements in several areas of the emergency organisation have been implemented. Regarding staffing and organisation of communication between emergency centres on site, additional personnel have been dedicated to special tasks in the onsite emergency centres (Postes de Commandement, PC) of the emergency organisation. People are dedicated to improve the data transfer from the control room to the on site emergency management centre (PCD), and a specialist is detached as a liaison person to the Prefect. An improvement of communication and data transfer has been implemented by introducing information technology into the communication process.

Due to its geographical position, Tricastin NPP is close to the border of 3 neighbouring ”Départements”. In case of an emergency in each “Département” the Prefect would be in charge of offsite emergency preparedness for his “Département” with the ”Préfet du Département de la Drôme” in the lead. It is well understood that the ”Préfect du Département de la Drôme”, who is alerted by Tricastin NPP, would immediately forward the alert and the information to the neighbouring departments.

Basic emergency functions of emergency preparedness are well covered. Tricastin NPP co-operates with the offsite emergency organisation and has good contacts and co-operation with supporting organisations. Equipment dedicated to emergency preparedness in the different centres is modern and well maintained. Exercises have been performed and have resulted in important feedback and improvement of the plans and procedures. Regarding training and competencies of the personnel of the emergency organisation, Tricastin NPP has taken a leading role to provide the competencies necessary to perform the tasks and the knowledge and training required.

The plant has also taken a leading role in several other areas in improving emergency preparedness and contributes to activities on the corporate level of EDF. This feedback has been instrumental in reforming some areas of emergency preparedness of the EDF fleet. The plant is encouraged to continue its efforts in this field.

8.2. EMERGENCY PLANS

Emergency plans have been developed by all organisations involved. EDF corporate level provides a basic emergency plan which is modified and amended to the extent necessary by the local emergency management organisation of the NPP. On a regional level the staff of the crisis centre of the Prefect prepares a plan for Tricastin NPP, the Prefect contracted a former staff member of Tricastin NPP to provide support in the development of the plan.

Due to a decree of the French Government issued to improve the protection of the public, the NPPs are put in the position to trigger sirens in the event preventive protective measures must be initiated quickly under special conditions. These sirens actually are implemented or under construction at the sites in France and are considered an important contribution to the protection of the public. A new off-site emergency plan is under development which will take account of this situation. Though the Prefect still is responsible for emergency preparedness and will be in charge to make decisions, the new philosophy may put a higher demand on the preparedness and actions of authorities on the local level. The authorities on the local level are in close contact with the Prefect in this area. The team encourages Tricastin NPP and the regional authorities to support the local authorities in the preparation of documents, action sheets and information.

Regarding site emergency preparedness, Tricastin NPP is in a special situation due to the fact that chemical plants processing and handling potentially hazardous chemicals such as UF_6 and HF are neighbouring the site. Due to its unique situation in the EDF-fleet, these hazards are not covered by the corporate plan. Tricastin NPP has made an effort to include this potential hazard into its onsite emergency plan and has worked out procedures to handle such external events. Additionally, the plant has worked out an agreement with the neighbouring company, COGEMA, on notification and on mutual use of the information centres available on each site in case of an accident. The effort taken is recognised by the team, but the team suggests that Tricastin NPP consider seeking agreements to be quickly informed (within less than 15 minutes) of an accidental release in one of the nearby chemical plants.

The emergency plan of Tricastin NPP covers the operation of the emergency centres which are necessary to handle an accident considering several levels of severity and consequences. The actions necessary are well covered by procedures for emergency centres, which allows assessment of the source term and to activate and perform the emergency response in a convenient way. Due to the well scheduled structure of communication and of transfer of messages to the corporate level of EDF, and to the offsite authorities, the information on the status of the plant and recommendations on countermeasures can be provided in due time.

Additionally, to the agreement with COGEMA, further issues have been worked out to support the emergency preparedness in case of need. These agreements cover the supply of busses by a transport organisation, the treatment of contaminated or exposed persons in hospitals, the support by neighbouring nuclear power plants in the dispatch of measuring vehicles or sending experts to the Prefecture of the neighbouring ”Départements”.

Material to be implemented in case of an accident is available according to the design of the plant and well maintained. Additionally special devices, hydrogen combiners, are available from a regional pool and may be brought to the site in case of an accident.

For offsite emergency preparedness, an emergency plan is available and a new plan is under development. Effort is taken on a regional level to co-operate with schools to identify suitable places for intermediate protection of the pupils before they are evacuated and to advise the teachers and pupils on behavioural conduct. Support is available from the civil defence of France and well defined. If the need arises support can also be called in from military forces.

8.3. EMERGENCY PROCEDURES

To guide the actions of the staff of the onsite emergency centres and of the staff performing actions in case of an emergency, good procedures have been implemented. Additional to the set of procedures derived according to the corporate level basis, Tricastin NPP has taken special actions to improve two fields of emergency preparedness. A procedure to implement protective actions against a threat due to hazardous chemicals approaching the plant and a procedure on the distribution of iodine tablets to ensure the protection of staff against radioactive iodine have been worked out. The procedures available to cover emergency preparedness actions are good, well prepared and are within a QA-system. Action sheets are enclosed in a plastic sleeve. In connection with the QA-process, this ensures completeness of the forms and is a good contribution to effective performance of emergency preparedness. The procedures have been tested in exercises and feedback has been implemented from the experiences gained. In the procedures the action steps to be taken are well defined and allow for graded response. The team, however, recognised that the procedures do not provide a space to sign off actions taken. The team made a suggestion in this area.

The procedures available cover all necessary actions to be taken by the emergency organisation in case of an emergency and were found to be effective.

Notification and classification of the situation are performed by the staff applying dedicated charts. The data is supplied from the plant control room and is transferred and checked by dedicated staff. In the evaluation and judgement of the status of the plant and the potential consequences, a diagnostic and prognostic approach is applied to judge the three barriers available to retain the radio nuclides (3D/3P-approach). In this judgement and especially in the evaluation of measured releases from the stack, care is taken to account for uncollected leaks from the containment to assure a conservative judgement of consequences. Recommendations on protective measures for the staff and the public are based on the prognosis of the situation. Additionally to the actions taken in the development of new procedures, Tricastin NPP is the first unit of the 900 MWe EDF fleet of to implement the state oriented approach in the handling of incidents and accidents of the plant in the control room. Staff of Tricastin NPP has taken a leading role to develop, to test and to implement the procedures in co-operation with the Bugey training centre. This is considered an effective process in the improvement of emergency preparedness.

8.4. EMERGENCY RESPONSE FACILITIES

Tricastin NPP has implemented emergency response facilities to host the staff of the emergency organisation on site. “Postes de Commandement” (PC) have been installed for management of the crisis (PCD), for assessment of the situation (PCC), for technical support (PCM), for the support of the communication transfer between the centres (PCL) and for the evaluation of the status of the unit in parallel to the operators in the control room (ECL). These centres generally are well equipped and operated. Documents and procedures are updated regularly. An emergency centre is available to host the PCD, PCC and PCM. This centre has a filtered ventilation system and food supplies for a certain time. It is designed to allow the entrance and exiting of the building during an accident and to decontaminate persons who arrive. The centre gives a good environment for the staff active in case of an accident. To improve the protection of this centre, Tricastin NPP is encouraged to evaluate whether a contamination transfer might be possible during persons entering or exiting the centre and in case to take appropriate measures for prevention.

The communication and information transfer between the centres has been significantly improved by implementation of intranet e-mail functions into the communication. This significantly improves the readability of data and messages and also the transfer speed and handling and filing of documents. The availability of the intranet function also gives access to the data base available on site. To the extent necessary, personnel have been dedicated to positions to type in the data. The fax system is available as a backup system for information transfer. Due to exercise experience the new system is judged very positive and efficient by the staff of the centres in charge. The team considers this improvement of information transfer to be a significant improvement for plants, which do not have a direct data transfer (SPDS) to the management centre. A medical station is available on site which allows for medical treatment and has dedicated decontamination facilities to handle a combination of an injury and contamination. A fall back centre exists off site to host staff evacuated in case of an emergency. Busses will be available to transfer people to the fall back centre. Gathering points are implemented to collect and to account for personnel. These points are suitably located. They are equipped to measure the dose rate and the contamination, but do not provide for detection of airborne concentration of radionuclides. The team made a suggestion in this area.

Emergency response facilities of the regional authorities and of the corporate organisation are exceptional. A technical support centre for the authorities on a national level is available. Both national centres have access to the plant data in case of an emergency and in parallel are provided with regular messages issued by Tricastin NPP.

The centre of the fire brigade supporting Tricastin NPP in case of a fire has good equipment covering all needs of intervention and through the regional co-ordinating centre can be supported by other fire brigades in the area.

8.5. EMERGENCY EQUIPMENT AND RESOURCES

Tricastin NPP has a mobile compressor and special shielding material available which consists of large concrete blocks which weigh 5 to 10 tons. Hydrogen combiners are stored at another power station and may be transferred to the site if needed. The equipment on site is adequately stored and maintained. Access to the storage area on site is ensured by painted warning information on the access roads to the mobile compressor. As handling of the shielding material needs a fork lift and is delicate due to the need to position the heavy blocks exactly in a quite narrow dedicated area inside the plant, Tricastin NPP has installed a mock up area for training outside to allow the training of staff. This practice eliminates the need to enter the controlled area and therefore does not endanger the plant or staff. The team considers this to be a good practice.

8.6. TRAINING, DRILLS AND EXERCISES

Training on emergency tasks in Tricastin NPP is based on the document defining the specific profile for on call people in the different Postes de Commandement, the competencies necessary to perform the tasks and the knowledge and training required in the different positions. Four specific training sessions and a refresher training have been developed to fulfil the training demand of the staff for their tasks in a crisis. Instructors are specialised for this training.

For personnel in charge of communication with the media, special training is provided on the corporate and local levels.

Tricastin NPP has implemented a very ambitious program of exercises on site to test the performance of the crisis organisation and the staff in charge of tasks in the organisation. The intention is to assure that all staff members of the crisis organisation are engaged in an exercise each year to obtain good expertise and feedback of the organisation. The number of exercises performed is considered a good way to ensure the best performance of the emergency preparedness organisation and to gain feedback for improvement.

A comprehensive effort is also implemented by the corporate level of EDF on big exercises. For 2002, thirteen exercises are planned to be performed over the EDF fleet. EDF aims to have one big exercise every three years for each plant.

8.7. LIAISON WITH PUBLIC AND MEDIA

To inform the public on the need for emergency preparedness, a leaflet was distributed in 1993. To account for the changes implemented to improve the protection of the public (see chapter 8.2), a new leaflet is planned to be distributed in March 2002.

Additionally to this pre-information, Tricastin NPP and the corporate level of EDF make a significant effort to keep the public and the media informed about ongoing activities in the plant and in EDF. Information on details such as routine releases, events in the plant and performances of the plant are published. A free telephone system has been set up by Tricastin NPP to answer questions and to give information to the public. Media coverage is monitored by the organisations in an effort to be proactive.

Special dedicated personnel are available on a local and corporate level that are specially trained to work with media representatives. An effort has been taken on a corporate level to set up an impressive information centre with professional tools to inform the media and in this way the public. The team considers the efforts taken as good performance of the corporate organisation and a good tool to support the local organisation.

During the review it also was recognised that local authorities are very eager to inform the public and to improve information transfer.

DETAILED EMERGENCY PLANNING AND PREPAREDNESS FINDINGS

8.2. EMERGENCY PLANS

8.2 (1) Issue: It is not assured that the plant is quickly informed (e.g. within less than 15 minutes) of an accidental release in one of the nearby chemical plants.

Tricastin NPP is surrounded by several chemical plants with potentially hazardous materials and accounts for this by a special emergency plan. However, the plant does not routinely identify incoming hazardous chemicals released from these plants. Although, to cope with the hazards from chemical accidental releases of the surrounding chemical plants, the plant has filters for the incoming air and has implemented emergency procedures to be followed by the staff in case of UF6 and hazardous chemicals endangering the plant. The measuring vehicles used during accidents are equipped with measurement devices to measure hazardous chemicals. Additionally, an agreement on information in case of an accident has been signed with COGEMA. This agreement, however, does not assure that the plant is quickly informed about an accidental release. Due to lack of fixed installed detectors for hazardous chemicals it is not possible for the plant to detect such chemicals routinely.

Not being quickly informed about a release of hazardous material, could prevent the plant from implementing emergency countermeasures at the appropriate time to protect individuals at the plant

Suggestion: The plant should consider further measures to assure that it is quickly informed about any accidental release in one of the neighboring chemical plants.

8.3. EMERGENCY PROCEDURES

8.3 (1) Issue: The actions sheets used in the Poste de Commande (PC) do not provide a way to indicate which actions have been performed.

Emergency action sheets, which are used in the Poste de Commandement (as for example e.g. the Local Management Command Centre (PCD) and the Local Assessment Emergency Centre (PCC)) should guide the staff to the actions to be performed and should document that actions were performed. Some of these sheets are used recurrently to ensure proper actions. The action sheets do not provide a way to indicate, which actions have been taken. In this case an action to be performed might be missed.

Missing an action in the work of a Poste de Commandement in case of an accident may result in a poor performance to protect the public, the plant personnel or the plant.

Suggestion: Consideration should be given to improve the plant action sheets in a way to indicate that actions have been performed and when they were performed.

8.4. EMERGENCY RESPONSE FACILITIES

8.4 (1) Issue: The plant does not provide means to quickly determine the concentration of airborne radioactivity at sites where workers gather during emergencies.

For rapidly developing emergency scenarios the concentration of airborne radioactivity may quickly rise in the plant and at the gathering points for plant workers. Under these conditions it is necessary to quickly determine the airborne contamination levels so that proper actions can be taken. Additionally, higher airborne concentrations may result in the transfer of airborne material into the emergency building

Presently, in case of an accident, staff will preferably be sent to the upwind gathering stations and a measuring vehicle will determine the airborne concentration on site. There are no continuous air monitors available at emergency gathering points.

Lack of continuous update of information on the airborne concentration and of protection from inhalation and contamination may result in reduced protection and increased exposure of the staff in case of an accident.

Suggestion: The plant should consider ways to provide means to quickly determine the concentration of airborne radioactivity at sites where workers gather during emergency.

8.5. EMERGENCY EQUIPMENT AND RESOURCES

8.5(a) Good Practice: For Accident management measures, special shielding devices are necessary to be implemented in a controlled area in the plant. This needs to handle very heavy concrete block of weights ranging from 5 to 10 tons by a forklift in a very narrow area to precisely position them as radiation protection shielding. To facilitate the training of staff, the plant has prepared a special dedicated out side area to give the staff the possibility to train without interfering the operation of the plant and without the hazard of damaging equipment inside the plant during training. This area is used up to 12 times a year to get persons used in setting up the device. Using dedicated training areas for special training of accident management material will enable the staff to get more practice easily and with less effort and especially without endangering the plant. It is considered a good practice and is recommended for other plants with similar accident management provisions.

DEFINITIONS

DEFINITIONS - OSART MISSION

Recommendation

A recommendation is advice on how improvements in operational safety can be made in the activity or program 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 programs or to point out possible superior alternatives to ongoing work. In general, it is designed to stimulate the plant management and supporting staff to continue to consider ways and means for enhancing performance.

Good Practice

A good practice is a proven performance, activity or use of equipment which the team considers to be markedly superior to that observed elsewhere. It should have broad application to other nuclear power plants and be worthy of their consideration in the general drive for excellence.

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